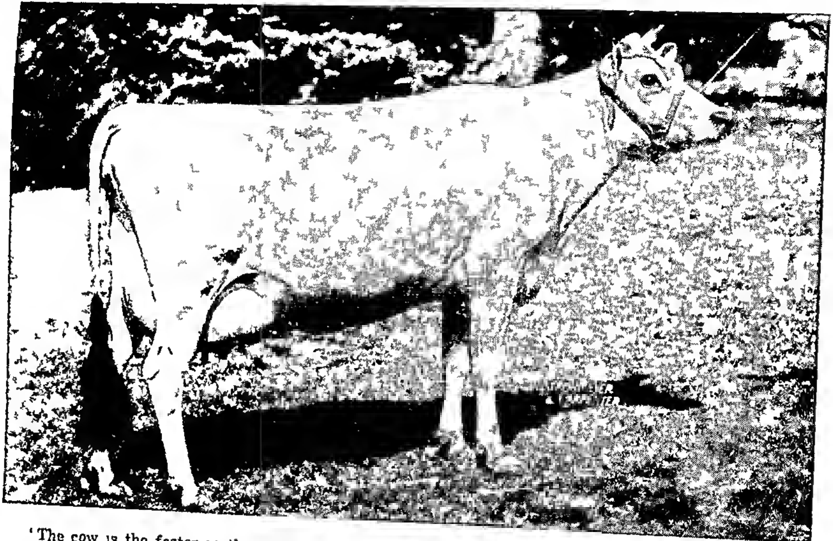

'The cow is the foster mother of the human race From the day of the ancient Hindu to this time have the thoughts of men turned to this kindly and beneficent creature as one of the chief sustaining forces of human life"—W D Hoard

DAIRY FARMING IN THE SOUTH

By

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Published by THE INTERSTATE Danville, Ill

THE INTERSTATE
Printers and Publishers
Danville, Ill.

Revised Edition

FOREWORD

This book deals specifically with the problems of dairy farming in the South.

It has been written primarily for use of pupils enrolled in vocational agriculture classes and students in agricultural colleges in the southern states. It is hoped that it will serve as an aid to pupils seeking factual information to guide them in setting up and carrying on profitable dairy farming programs on their home farms.

Each year there are approximately 200,000 Future Farmers of America who study vocational agriculture in the public schools of the South. Since year after year thousands and thousands of these young men enter farming, they are playing an ever increasing role of importance in helping to improve farm practices and management on southern farms. They are learning through doing under the guidance and direction of their agriculture teachers and parents. Through their home projects, many are pointing the way to improved practices and more profitable farming.

It is generally recognized that there are many problems in dairy farming that are peculiar to the South. Problems in feeding, parasite control, pasture development, and general management are somewhat different from those in other sections of the nation. The very fact that the South has feed crops and climatic conditions that are different from those found in other regions, sets it apart as an area having special problems in the production and marketing of dairy products. Material is included in this book that deals specifically with the jobs and problems that are peculiar to the South.

In developing the contents for this book use was made of the factual information developed through

studies made by Agricultnral Colleges and Experiment Stations of the South. Technical terms have purposely been avoided wherever possible. This was done with the hope that the book would be easily understood by high school pupils enrolled in vocational agriculture classes.

There was no attempt in the preparation of this book to set up practices or programs applicable to specific farms or to the region as a whole. The purpose was to present factual material, so analyzed and interpreted, that it would give individual farmers and Future Farmers a basis for developing sound programs and practices on their individual farms—regardless of the section of the South in which they are located.

The authors of "Dairy Farming in the South," are well qualified through years of experience and study to write on this subject. They are also familiar with the method of teachlng used by vocational instructors and have thus arranged the material in a manner that will make the book very usable.

Roy H. Thomas became State Supervisor of Vocational Agriculture for North Carolina in 1919, which position he holds at present. During his long and successful period of service the departments of vocational agriculture in the high schools of North Carolina have increased from 21 with an enrollment of 223 in 1919 to 489 with an enrollment of more than 35,000 in 1943. Mr. Thomas has served as Editor of the Part-time Section of the Agricultural Education Magazine and has contributed many articles to farm magazines throughout the nation. He is the author of the text book, "Living Things Around Us," an agricultural reader for the elementary grades, and co-author of the text book, "Farm Crops."

Paul M. Reaves has served since 1928 as a member of the staff of the Dairy Husbandry Department of the Virginia Polytechnic Institute. Prior to accepting this

position he served as a teacher of vocational agriculture in Tennessee; spent one year doing graduate work in Dairy Husbandry at the Iowa State College; carried on for a short period of time official testing work in Tennessee and Ohio; and for five years managed the Bellwood Dairy Farm at Maryville, Tennessee. As a result of all this experience it is evident that Mr. Reaves is well qualified to assist with the writing of a book on dairy farming in the South.

C. W. Pegram, Chief of the Dairy Division of the North Carolina Department of Agriculture, has had extensive experience and training in the dairy industry. For a number of years he served as Dairy Manufacturing Specialist with the Virginia Polytechnic Institute and the Virginia Agricultural Extension Service. Mr. Pegram is thoroughly familiar with the problems with which Southern Dairymen are confronted. It is as a result of his knowledge of these problems that he was invited to participate in the production of this book.

It is the hope of the authors and the editor that this book will be helpful to those who study it and that through its use improved practices and more profitable dairy farming in the South will result.

M. D. MOBLEY, Editor.

PREFACE

"Farming in the South should consist of two arms—livestock and crops," says Dr. Clarence Poe, Editor of the Progressive Farmer and one of the South's outstanding farm leaders. It is generally recognized that dairy farming should form an important part of the livestock arm.

The dairy industry has grown considerably in the South in recent years and without doubt is destined for further growth and development in the immediate future.

This book, "Dairy Farming in the South," has been written primarily for the use of pupils enrolled in vocational agriculture classes and students in agricultural colleges in the southern states.

It is the hope of the authors that the facts presented in this book will help present and future farmers of the South to better understand the problems connected with dairy farming and will be the means of encouraging the use of improved practices, thus resulting in greater profits from this enterprise.

We wish to express our grateful appreciation to the many people who furnished pictures, illustrations and other material for this book. Especially are we grateful for the pictures furnished by individual dairymen in the South.

ROY H. THOMAS

PAUL M. REAVES

C. W. PEGRAM

The Authors.

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Chapter 1

THE IMPORTANCE OF DAIRYING IN THE SOUTH

Agriculture has developed in the Southern States from the growing of crops, chiefly cotton and tobacco. There are a number of reasons for this type of farming. Early settlers found ready markets in England for tobacco after smoking was introduced by Sir Walter Raleigh. Markets were also available for cotton during the Colonial period. The development of the cotton gin and textile mills played an important role in the increased production of this crop. The introduction of slavery in the South was also a factor in the growing of these two crops as they could be produced with cheap, unskilled labor. The slaves, most of whom were unskilled, could be used more profitably in a system of cultivated crops than in livestock production.

In light of these facts the South developed a cotton and tobacco economy and for years millions of acres have been devoted to these two crops. During this time marked progress in both production and quality have been made.

Southern Farmers at Crossroads

In recent years Southern farmers have been at the crossroads. Limited markets have been available for their two chief money crops. Other countries have learned to grow cotton and tobacco in quantity. Both these crops were for years our chief export commodities. Until recent years a large percent of the cotton and tobacco produced in America was sold in foreign markets. There has been a gradual decline in the foreign demand for these two commodities, and the domestic consumption has not increased sufficiently to

offset the losses in foreign markets. This situation is making necessary drastic changes in the South's farming program. In this changing program, dairying is proving a profitable enterprise on many Southern farms.

Statistics[1] show that between 1924-1937, the average annual gross income per capita of farm population in the eastern Cotton Belt amounted to $162, while that of the rest of the United States amounted to $381. During this same period the farm workers of Iowa, Illinois, and Indiana received annually $483 per capita.

Dr. Clarence Poe, noted agricultural writer and leader, terms southern farming as being "one armed" or "lopsided." Even though there has been a marked increase in livestock farming in the South, he found that only $20 of the farm income in the Sonth was derived from livestock, dairying, and poultry for each $100 received from farm crops.

In order to prevent the growing of large surpluses, farmera have been restricted in the acreage that may be devoted to cotton and tobacco under the Agricultural Adjustment Administration program. This has released millions of acres formerly devoted to cotton and tobacco. More and more of this land is being planted to feed crops and is being marketed throngh livestock—including dairy cows.

The program of the Soil Conservation Service calls for the growth of more grasses and hays than were formerly produced. Such crops are usually more profitable when marketed through livestock.

Milk furnishes the largest cash income for American agriculture. This is not generally recognized. Figure 1 shows very clearly the amount and percent of cash income derived from various farm enterprises.

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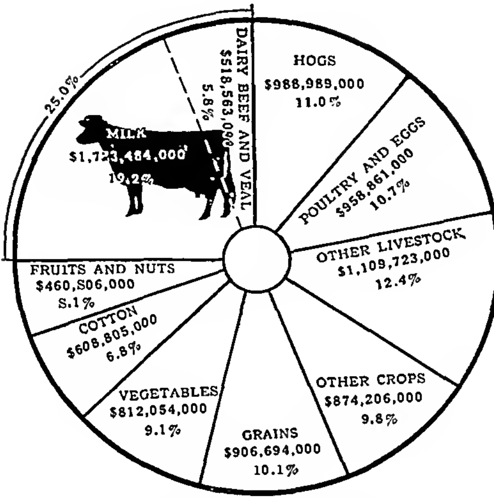
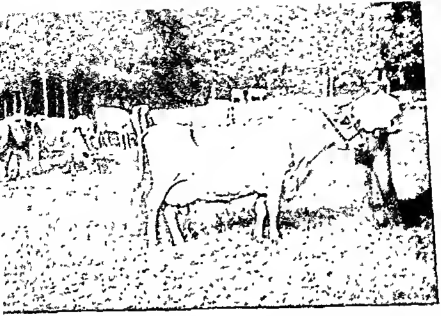
[1] Land Policy Review, July-August, 1940.



Courtesy Hoard's Dairyman

Fig. 1. Gross Farm Income. The gross farm income in 1939 totaled $8,961,885,000, according to estimates by the U. S. Department of Agriculture. One-fourth of this total is supplied by the dairy cow if the value of the beef and veal she supplies is added to the value of her dairy products. This two and a quarter billion dollars is two and a half times the gross farm income from all grains and nearly four times the income from cotton. Gross farm income consists of the cash income from the sale of crops, livestock and livestock products from farms, plus the value of these products consumed on the farm table where they are produced.

In order to get a true perspective of dairying in the South one should study Tables 1, 2, and 3. The information presented by these tables shows that dairying is definitely on the march in the South. Farmers are learning to grow, on an efficient basis, grasses, legumes, and other crops that are essential to profitable dairy-



Courtesy U. S. D. A.

Fig. 2. Southern Scene. Dairy herds such as the one shown here are becoming more common in the South. In recent years great improvement in the producing ability of herds has been made. This herd is located in Newberry County, South Carolina.

ing. The feed bag type of dairyman is fast getting out of the dairy business. Efficiency is the order of the day and dairying is no exception to this rule.

TABLE 1—COMPARISONS OF GROSS FARM INCOME AND SELECTED FARM ENTERPRISES FROM SOUTHERN STATES

(Preliminary—1947)

States	Cotton and Cotton-seed	Tobacco	*Peanuts	Hogs	Dairying	Gross Farm Income All Commodities (Including Government Payments)
	(Add 000) $	(Add 000) $	(Add 000) $	(Add 000) $	(Add 000) $	(Add 000) $
Virginia	3,405	59,774	20,425	56,605	58,571	451,163
North Carolina	87,320	359,848	35,254	65,943	51,177	922,168
South Carolina	135,675	64,997	1,655	42,714	34,570	394,495
Georgia	177,259	42,495	72,050	89,462	65,759	543,340
Florida	2,264	15,054	5,224	24,017	35,290	441,479
Tennessee	101,646	55,616	420	87,570	101,016	535,518
Alabama	177,255	136	25,209	58,531	70,040	437,144
Mississippi	313,222	—	437	45,849	64,717	423,121
Arkansas	241,179	—	213	53,872	57,714	532,332
Louisiana	97,745	149	134	35,059	39,668	320,138
Oklahoma	62,026		13,624	58,731	85,149	574,253
Texas	653,515	—	32,751	115,458	200,654	1,525,805

*Picked and threshed.
SOURCE: N. C. Federal-State Crop Reporting Service

TABLE 2—COMPARISON BY STATES OF NUMBER OF COWS ON FARMS, POUNDS OF MILK PRODUCED, AND AVERAGE AMOUNT OF MILK PRODUCED PER COW
(Preliminary—1947)

State	Number of Milk Cows on Farms	Total Pounds of Milk Produced on Farms	Average Amount of Milk Produced per Cow
		(Add 000,000)	
Virginia	442,000	1,901	4,300
North Carolina	359 000	1,529	4,260
South Carolina	162,000	593	3,660
Georgia	360,000	1,202	3,340
Florida	131,000	498	3,800
Tennessee	593 000	2,265	3,820
Alabama	391,000	1,341	3,430
Mississippi	480 000	1,363	2,840
Arkansas	420 000	1,306	3,110
Louisiana	278 000	664	2,390
Oklahoma	660 000	2,343	3,550
Texas	1 270,000	3,950	3,110

SOURCE N C Federal-State Crop Reporting Service

Yet large quantities of fluid milk, butter, cheese, and condensed milk are still being shipped into the South. Transportation costs on these items amount to a large figure. Fresh milk has a better flavor than milk shipped a great distance. These factors give southern farmers an advantage. Then the population of the South is increasing and, as a result, there is an in-

TABLE 3—TOTAL NUMBER OF FARMS, NUMBER AND PERCENTAGE OF FARMS NOT REPORTING COWS MILKED FOR SPECIFIED YEARS

States	Total Farms		Farms not reporting cows milked			
	1935 Number	1940 Number	1934	1939	1934 Percent	1939 Percent
Alabama	273,455	231,746	66,687	60,167	24 4	21 6
Arkansas	253,013	261,674	65,726	55,904	26.0	25 8
Florida	72,857	62,248	44,339	85,324	60 9	56 7
Georgia	250,544	216,033	71,743	67,537	28 6	26 6
Louisiana	170,216	150 007	64,877	46,407	38 1	30 9
Mississippi	311,683	291,032	106,601	99,185	34.2	31 1
Oklahoma	213,325	179 687	31,199	26,216	14.6	14 6
Texas	501,017	418,002	121,284	79,921	24.2	19.1
South Carolina	165,504	137,558	66,358	49,828	40.1	36.2
			(1935)	(1940)		
North Carolina	300,967	278,276	106,800	98,200	35 0	35 0
Virginia	197,632	174,887	49,500	42,300	25 0	24 0
Tennessee	273,783	246,617	67,200	62,500	21 0	21.0

Source. U S. Census Data and U S D A.

creased consumer demand for dairy products which makes the outlook for dairy farming in the south very bright.

Though the total gross income from dairying for the twelve southern states has greatly increased in recent years there is still much evidence that expansion in dairy production is greatly needed in the South in order to meet market demands and in order to meet nutritional requirements of the people living in this area.

There are a great number of farms in the South on which there are no milk cows. Table 3 gives by states the number and percent of farms without milk cows. Note that in one state more than 50 percent of the farmers are without milk cows.

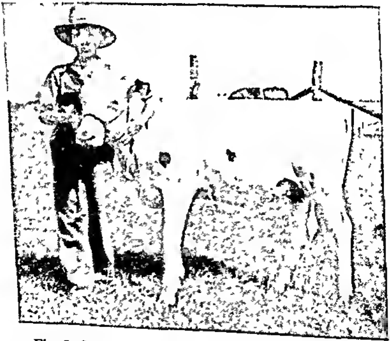


Fig. 3. Interested Youth, the Hope of the Future. The favorable attitude of rural youth toward modern dairy practices is a definite insurance factor for better herds, better pastures, and a greater dairy industry in the future.

Courtesy J. A. Arey, N. C. State College Ext. Dairyman

Fig. 4. Abundant Shade. During the long summer months the dairy herd needs plenty of shade as a place of refuge from the intense heat. The picture above shows a portion of the Hugh McRae pasture, near Wilmington, N. C.

Dairy Farming Builds Soil Fertility

Much of the farm land of the South is poor due to the soil depleting cropping system that has been practiced. Cotton and tobacco, if grown year in and year out on the same land, use up certain soil nutrients. The clean cultural practices which these crops require cause land to erode. This accounts for the necessity for heavy applications of commercial fertilizers. Dr. H. A. Morgan, of the Tennessee *Valley Authority*, once said "Livestock is an essential factor in the mineral-plant-animal cycle basic to all sound agriculture. Agriculture without livestock is a violation of natural laws and leads to mining the soil of its fertility."

Manure, a by-product of dairying, offers an effective means of increasing soil fertility. It has the three following soil-building values: (1) physical, (2) chemical, and (3) bacterial. Organic matter increases water holding capacity, and improves the physical condition of the soil. Morrison shows that one ton of average cow manure contains 12 pounds of nitrogen, 3 pounds of phosphoric acid, and 9 pounds of potash. The chemical

value is estimated at about $20 to $30 per cow annually. The bacterial action from the application of manure to the soil also makes for better physical condition of the soil. The Tennessee Experiment Station found from a long period study of the value of manure that the average gross return was $4.36 per ton. This should be worthy of serious consideration of Future Farmers in the South where millions of dollars are spent annually for commercial fertilizers.

The sale of one thousand dollars' worth of 35-cent butter removes less than $1.00 in value of plant food, whereas one thousand dollars' worth of cotton seed at 30 cents per bushel removes approximately $442.67 worth of plant food. One thousand dollars' worth of 25-cent tobacco removes $29.04 worth of plant food. Comparatively few farmers realize that every time a ton of hay or grain is sold off the farm that $8 to $10 worth of soil nutrients are removed.

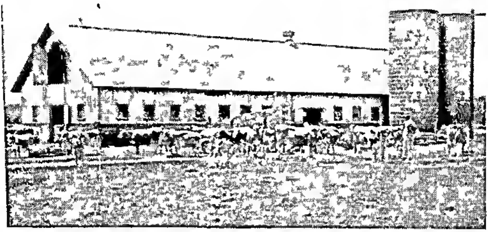
Dairying Offers Year Round Labor Income

Returns from the marketing of cotton and tobacco are received during one period of the year. This works to many disadvantages as cash income is needed throughout the year to meet current expenses of the farm and home. Dairy farming offers profitable employment of children since they can do many of the jobs and chores connected with this enterprise.

The growing of cash crops usually requires about six months of hard intensive labor, while dairying furnishes year round employment. Successful men in other walks of life, either business or professional, find it necessary to devote full time to their work. In order for one to make a living by working only 6 to 8 months of the year requires that a high income be received for this period.

Dairying Promotes Thrift

Dairying promotes thrift as it makes it possible for farmers to live on a cash basis rather than on a credit basis which sometimes carries high interest charges Then, too, a good dairyman usually has a desire for better cows, barns, or equipment which furnish incentive to save.



Courtesy U S D A

Fig 5 A Guernsey Herd This breed is increasing in popularity in the South The herd shown here is located in Akin County, South Carolina

Income from Dairying

Cows will furnish a sure income when good feeding and management practices are used The returns per cow vary according to production of cow and the market available. An average cow, when properly fed, will produce 6000 pounds of milk annually containing 250 pounds of butterfat This milk sold for fluid consumption at $4 00 per hundred will bring $240 The value of the manure when used for growing crops and land improvement will amount to approximately $30 per year This makes a total income per cow of $270 annually.

In case the milk is sold to a creamery for butter, 250 pounds of butterfat at 50 cents per pound will

bring $125 and the skim-milk will be worth approximately $20 for feeding to poultry, pigs, or calves. The income per cow from this type market will amount to approximately ($125 butterfat, $20 skim-milk, and $30 manure) $175. In cases where proper handling is given to manure, double returns are received from the feeding of feeds rich in fertilizing nutrients such as cottonseed meal.

The total yearly production of solid and liquid manure of a 1000 pound dairy cow amounts to approximately 12 tons without bedding, and from 14 to 15 tons with bedding. Probably only one-third of its value is actually lost due to faulty handling, leaching and fermentation. Some dairymen use superphosphate on barn floors and gutters. This compound acts as an antiseptic and is effective in preventing loss of ammonia. Manure being low in phosphoric acid (P_2O_5) is supplemented by such addition. This practice also helps to control flies since superphosphate is a fly repellent.

Bedding is needed to keep cows clean and to absorb liquid manure which is valuable. Oat straw, wheat straw, shavings and saw dust are used for this purpose. Though saw dust adds practically no fertility to the soil, it makes the manure easier to handle and absorbs the liquids.

Detailed information relating to daily production and composition of solid and liquid excrement of cattle is shown in the following table:

TABLE 4—COMPOSITION OF FRESH EXCREMENT

Daily Production Per Animal		Dry Matter		Nitrogen		Phosphoric Acid P_2O_5		Potash K_2O		Lime CaO	
Solid	Liquid	Solid	Liquid	Solid	Liquid	Solid	Liquid	Solid	Liquid	Solid	Liquid
Pounds	Pounds	Per-cent	Per-cent	Per-cent	Per-cent	Per-cent	Per-cent	Per-cent	Per-cent	Per-cent	Per-cent
52.0	20.0	16.2	6.2	.33	.95	.21	.03	.16	.95	.34	.01

Taken from U. S. D. A. 1938 Year Book "Soils and Men" page 450.

The labor income from dairying is dependent upon a number of factors such as management, market, production of cows, and feed costs. Southern farmers are offered in dairy farming an opportunity to secure year round and profitable labor income. In determining the total labor income derived from dairying, the indirect returns, such as manure and skim milk should be included as a part of the total receipts.

SUGGESTIONS FOR STUDY

A. Questions and problems.

1. Why was dairying not developed by early Southern planters?
2. Why is it necessary for Southern farmers to change to other crops?
3. What does dairying offer in regard to market outlet?
4. What are the three values of manure?
5. What income may be expected from dairying?

B. Activities.

1. Secure data on cow population and income from dairying for your state, county, or parish from census figures. If possible, secure information as to the amount of dairy products imported to your state, county, and community.

C. References.

United States Department of Agriculture Crop Reporting Service.

Feeds and Feeding, F. B. Morrison.

CHAPTER II

PRODUCING MILK AND DAIRY PRODUCTS FOR HOME USE

A Government fact finding body says, "four-fifths of all that the people in the South eat and wear is produced outside the region." This statement, if true, should be remedied as soon as possible. As long as this condition exists we may expect to be the "Economic Problem Number One" of the nation. The South should at least be self-sufficient in food production, which means that it should not be dependent on other sections for food. This is especially true during periods of emergency.

Number of Cows Needed to Supply Family of Five:—It requires two cows to furnish sufficient milk and butter to meet the dietary needs of a farm family of five. Scientists and nutrition experts recommend a minimum of one quart of milk daily for each child and one pint for each adult. They also suggest one pound of butter for each person per week. Since a cow should have a rest period each year, the family will not have an adequate milk supply during this time unless an additional cow is available.

While two good cows in production at the same period might produce more than the requirements for a family, the surplus milk or dairy products can be disposed of profitably in most localities. Many farmers make the mistake of depending too much on this excess production, whereas five to ten cows make a more efficient profitable farm unit.

Care of Milk on the Farm:—The care of milk on the farm is important. It involves three big Cs, namely

—cleanliness, cooling, and convenience. It does not require a big outlay to convert a shed or stable into a suitable place for milking. Stanchions may be made from 2 x 4 lumber. Cement floors, for the space where the cow stands, may be made from a few sacks of cement and a load of sand and stone.

Clean milk begins with healthy cows. It is also necessary that all utensils should be scrupulously clean. Laundry soap is not satisfactory for the washing of utensils. Alkali washing powders should be used. This

Courtesy U. S. D. A.

Fig. 6. Milking. In the South much of the milking of cows kept for home use is done by women.

latter is not suitable on aluminum utensils in which case ordinary laundry washing powders are satisfactory. Galvanized buckets should not be used for milking purposes as metal poisoning might result should milk or cream sour in them. The seams are not flush and cannot be easily cleaned. Heavy and well tinned pails

Courtesy U. S. D. A.

Fig. 7. Use Small Top Milk Pails. They keep much dirt from falling into milk as it comes from the cow. Dirt carries bacteria which are harmful to milk. Such contamination should be kept out; it can not be strained out. Smooth surfaces are necessary for milk pails. Those with rough surfaces, like the galvanized pail at the left, are difficult to clean thoroughly.

and cans prove more satisfactory. The covered milk pail, which is required by market milk regulations, aids in preventing hairs and dust from falling into the bucket during milking.

The grooming of cows with curry comb and brush also aids in the production of clean milk. Cows should

be kept in barns or sheds which are provided with liberal bedding such as wheat or oat straw or wood shavings.

Milk as drawn from a healthy cow, whether scrub or purebred, is usually of good quality and carries a

Fig. 8 Learning to Milk. Many Future Farmers learn to milk as a part of their supervised practice program in agriculture.

low number of bacteria. The bacterial count is usually considered the index to quality. It is obvious that high quality milk is dependent on the care given it after it is drawn from the cow.

Most farm women prefer to strain milk. Unless the straining cloths are thoroughly washed and boiled they are usually sources of contamination. The single service cotton filter pad is more satisfactory for straining as it is very efficient and is discarded after being used. The temperature of milk as drawn from the cow is around 95° Fahrenheit. Bacteria, which cause souring, grow rapidly at a temperature above 60° Fahrenheit. Cold water from a well or spring is very satisfactory for the removal of animal heat from milk. Water cools milk approximately eighteen times faster than cold air. Milk may be stored after cooling in spring house or electric refrigerator provided no vegetable or meat odors are present, as milk, cream, and butter absorb odors very easily.

Making Butter at Home:—Buttermaking is an important task in the farm home. Large amounts each year of poorly made Southern farm butter either go begging for a market or bring a low price. Though cream for buttermaking may be handskimmed with a ladle, the use of the cream separator is more satisfactory. Cream testing 27 to 35 percent butterfat gives best churning results. Hand skimmed cream usually tests 18 to 20 percent, which makes for more difficult churning.

One advantage of the use of the cream separator is that the skim-milk is ready for feeding immediately after separation. Fat losses are reduced to practically nothing by the separator.

The wooden barrel churn is generally preferred for farm buttermaking. The churn should always be kept clean. Before using, it should be flushed with scalding

Courtesy U. S. D. A.

Fig. 9. An Old Fashioned Churn. Many of the old fashioned type churns are still in use on Southern farms. Some of these are difficult to keep clean.

hot water followed by cold water. The hot water opens the pores of the wood and the cold water fills the pores so that the butter will not stick to the churn.

It is not necessary that cream for churning purposes be soured first as butter may be made from sweet cream, however, sour cream is easier to churn and

Courtesy Ext. Ser. U. S. D. A.

Fig. 9a. Making Butter at Home. This farm woman is making butter in her electric churn.

makes for a higher flavored butter and buttermilk. The temperature for churning usually is around 58° to 60° Fahrenheit. It is always advisable to use a dairy thermometer. The churn should not be over one-half full in order that cream will have room for concussion. The churning process should take approximately thirty

Courtesy Ext. Ser. U. S. D A.

Fig. 10. A Small Modern Churn. This type churn is found on many Southern farms. It is especially suitable on farms where electricity is not available.

minutes. The churning process is ready to stop when butter granules have formed about the size of popcorn.

The buttermilk is then drained off through a metal strainer in order to keep butter flakes from the buttermilk. The butter is then ready for washing. Water having the same temperature as that of the buttermilk is generally used. In summer it may be advisable to lower temperature several degrees. The amount of water to use for washing should be approximately the same as the amount of the cream used. The churn is rolled

Courtesy Ext. Ser. U. S. D. A.

Fig. 11. Preparing Home Made Butter for Market. Many farm women in the South sell surplus homemade butter. Usually higher prices can be obtained if regular customers are secured.

or turned several times in order that all buttermilk may be washed from butter. After the washing process is over the water is drained off and the butter is ready for salting. Salting is usually done at the rate of three per cent of the butter yield or ½ to ¾ ounces—or 3 to 4 teaspoonfuls per pound. The salt is worked into butter with a wooden worker or with a wood ladle. The working should be continued until the salt is dissolved and until the butter has a dry waxy appearance.

The butter now is ready for molding. Regular wooden molds either elongated or round are satisfactory. All butter should be weighed and standardized to weigh one pound. Regular butter parchment should be used for wrapping.

Butter should be stored in a cool place which is free from vegetable or meat odors.

Butter properly made will be enjoyed in the home or will find a profitable market. Too often farm butter is made from onion cream which is difficult to sell and which has placed farm butter in bad repute. There is no remedy for onion flavored milk or cream. The best method is not to allow cows to graze onion infested pastures early in the spring or late in the fall.

Making Cottage Cheese on the Farm:—Cottage cheese is n palatable and nutritious food and may be made in the farm home with a small amount of labor and time. Skim-milk may be used to advantage in the making of the product.

Cottage cheese is made on a large scale in dairy plants and it is gaining favor in most markets. The instructions given here are for making the product for home consumption. A vessel of skim-milk is taken from the separator and placed where the temperature will remain 70° to 75° Fahrenheit until it sours or clabbers. The best plan is to place the skim-milk vessel

Courtesy Ext. Ser. U. S. D. A.

Fig. 12. Storing Butter. Rural electrification has made it possible for milk and dairy products to be handled in a more satisfactory manner on many Southern farms. This woman is putting her newly churned butter into an electric refrigerator.

Courtesy Ext. Ser. U S D A.

Fig. 13. Checking the Temperature. During the process of making cottage cheese it is important to keep a careful check on the temperature of the milk.

in water having the above temperature. Souring or coagulation usually takes place in 12 to 14 hours. Sometimes it is advisable to add several tablespoonfuls of clean flavored sour milk. It should be stirred in when it is added. This hastens the souring.

When the milk has formed a thick, firm mass it is ready to be cut into two-inch squares. A kitchen knife is satisfactory for this purpose. The cooking process is the next step. Hot water of approximately 150° Fahrenheit is used until the cheese squares have

reached a temperature of around 120° Fahrenheit. In order that force of the water does not break up curd, water should be added gently through a colander. The heat will expell the whey from the curd. Sufficient cooking is indicated when the glossy appearance of the curd has disappeared. A wooden ladle is satisfactory for occasional stirring. If cooking is carried too far a

Courtesy Ext. Ser. U. S. D. A.

Fig. 14. Making Cottage Cheese. The curd of cottage cheese is being washed with cold water.

hard and dry product will result. Practice will assist the maker in ascertaining this process.

When cooking is finished, the curd may be drained through a colander or cloth bag. After draining, cold water is flushed over the curd and then drained again. Salt is added at rate of one percent or one teaspoonful for each pound of yield. Salt improves the flavor to a certain extent, but caution should be taken not to use too much. Cottage cheese should be stored in a cool place.

One gallon of skim-milk will yield around 1½ pounds of cottage cheese. This amount contains as much protein as 1½ pounds lean beef, 2¾ pounds salmon, or 10 eggs.

The addition of cream either sweet or sour will improve the quality and tastiness. Ground pimento peppers, olives and pickles also tend to make this product more appetizing and attractive.

SUGGESTIONS FOR STUDY

A. Questions and Problems

1. Why should every farm family keep two cows?
2. What are the important requirements necessary in the production of clean milk?
3. How can profitable markets be found for farm butter?
4. What are the important steps in farm butter making?
5. Is cottage cheese a good outlet for surplus skim-milk?

B. Activities

1. If possible make a tour of local dairy farms and plants. Take notes on methods used in the handling of milk.

2. If possible make arrangements for a butter-making and cottage cheese demonstration.

C. References

1. How to Make Cottage Cheese on the Farm—Farmers Bulletin No. 1451, U. S. D. A.
2. Improved Sanitation in Milk Production—Leaflet No. 3, U. S. D. A.

Chapter III

COMPOSITION, TESTING, AND VALUE OF MILK

The legal definition of milk is the whole clean fresh lacteal secretion obtained by the complete milking of one or more healthy cows, properly fed and kept, excluding that obtained within 15 days before and 5 days after calving. Milk may also be defined as a whitish or yellowish fluid secreted by the mammary glands of female mammals for the nourishment of their young.

Milk is a mixture of water, fats, carbohydrates, proteins, minerals, gases, enzymes, vitamins and bacteria. It is composed of 107 different recognizable substances. According to Richmond, noted chemist, cow's milk has the following composition:

Water	87.1 %
Fat	3.9 %
Casein and Albumen	3.4 %
Lactose or Milk Sugar	4.85%
Ash or Minerals	.75%
Total Solids	12.9 %

For convenience the ingredients of milk may be divided into three groups, namely, water, fat, and solids-not-fat. The composition varies with breeds and individuals within a breed. Butterfat is the most vari-

TABLE 5—AVERAGE COMPOSITION OF MILK OF MAJOR BREEDS

Breed	Percent Fat	Percent Solids-not-fat	Percent total solids
Holstein	3.45	8.55	12.00
Ayrshire	3.80	8.78	12.58
Guernsey	4.80	9.13	13.93
Jersey	5.00	9.22	14.22

able component as shown by the average composition of milk of four major breeds.

It will be noted that as the fat content increases the solids-not-fat also increases. Commercially, but not nutritionally, butterfat is the most valuable constituent of milk.

The first milk secreted after freshening is called colostrum, and is beneficial to the young calf. Since milk from a fresh cow is not normal milk it should not be used or offered for sale until 4 to 7 days after a calf is dropped.

Normal milk has a sweetish flavor and a faint characteristic odor. The average specific gravity is 1.032, which means that it is 1.032 times as heavy as water. One gallon of milk weighs 8.6 pounds.

Butterfat exists in milk as a mixture of fat made up of very minute globules. The size of globules varies with the breed of cow, and with the period of lactation.

Casein is a protein and is important in cheese making. It also has many industrial uses in the manufacture of paints, glue and plastics. Albumin is another protein which is present in small amounts in milk. This is similar to the albumin of the white of an egg.

Lactose or milk sugar is a carbohydrate found in solution in milk. It is only one-hundredth as sweet as ordinary sugar.

The mineral salts or ash are important nutritional constituents of milk. Calcium and phosphorus are bone builders and milk is regarded as our richest food source of these minerals. Iron is present in small amounts in milk, but insufficient for human body requirements.

Vitamins:—Vitamins are necessary for the body growth and health of humans and animals. Fourteen of these substances have been discovered. A number of them have been prepared in pure form. Their functions

have been clearly defined. Plants are the source of vitamins from which animals assimilate them either directly or indirectly. Milk contains some of nearly all the known vitamins, which chiefly are A, B (B_1 and B_2), C, D, E, and K.

Vitamin A, which is found in butterfat, stimulates growth and reduces susceptibility to certain infectious diseases, especially diseases of the eyes. The vitamin A content of milk varies with the amount furnished by the feed. Summer grasses, well cured alfalfa and clover hays fed to cows increase the amount of this life giving substance. In contrast cows do not require vitamin B in their feed. The vitamin A and D content of milk is influenced very greatly by the feed. Growing calves and cows require especially vitamins A and D.

Bacteria:—Bacteria are minute living cells found almost everywhere in nature. They are the lowest form of micro-organic life. Bacteria require food, warmth, water, and usually air. Since milk has all of these requirements, it furnishes favorable environment for growth. When bacteria grow in milk they change the lactose (milk sugar) into lactic acid, which sours the milk and finally coagulates it. Temperature is an important factor in the growth of bacteria. While bacteria can live in milk at low temperatures, 35° to 40° they are not able to multiply to any appreciable extent. They grow best at 60° to 90° Fahrenheit and this is why it is important that milk and cream be cooled below these temperatures.

Bacteria get into milk from utensils, from the hair and dirt on the coats of animals, from milkers' hands and clothes, and from the air.

All bacteria are not harmful. For example, the lactic acid producing organism is not. However, under unsanitary conditions pathogenic organisms may be found such as tuberculosis, typhoid fever, scarlet fever,

Courtesy U. S. D. A.

Fig. 15. A Cow Tester. This is Miss Ada Symington, a Texas girl, who studied Dairy Husbandry at San Marcus College and managed a herd of 70 Jersey cows on a farm near San Antonio, Texas. She became New Jersey's first woman cow tester during World War II. She is shown here weighing a pail of milk and taking a sample for making a butterfat test. Her report on each cow's production and feed cost enabled farmers to cull out inefficient producers and spot good breeding stock.

diphtheria and septic sore throat. Pasteurization, the heating of milk to 143° Fahrenheit and holding it at this temperature for 30 minutes, will destroy all pathogenic organisms.

Since bacteria count is an index to the quality of milk and cream, it is important that it be held low. This can be done by using sanitary methods in the producing and handling of milk, which means that cleanliness should be practiced and milk properly cooled.

Courtesy U. S D A

Fig. 16. Taking Sample. The pipette is being filled by suction of the mouth The pipette holds 17 6 cc. of milk.

Testing Milk and Cream for Butterfat:—One of the greatest contributions made to American Agriculture was the test for butterfat, named for its inventor Dr. S. M. Babcock. This is a practical test to determine the butterfat content of milk and cream. The principle

of the test is based on the fact that sulphuric acid with specific gravity of 1.825 to 1.835 will dissolve the solids in milk and set the fat free from its emulsion.

The test is simple and may be learned by any student willing to pay attention to details. In order to secure accurate results it is necessary that proper equipment be used and that representative samples of milk and cream be secured.

Equipment:—The equipment needed for school laboratory or dairy farm testing is as follows:

a. For testing milk—
   (1) One 24 bottle centrifuge, preferably motor driven with heating element and brake.
   (2) Two dozen 18 gram, 8 percent milk test bottles.
   (3) Two dozen 2-ounce sample bottles.
   (4) Two milk test pipettes, graduated to 17.6 cc. capacity.
   (5) One sampling dipper.
   (6) One pair needle point dividers.
   (7) One dairy thermometer, reading range 60° to 150° Fahrenheit.
   (8) One pair milk scales.
   (9) One hot water bath.
   (10) One gallon sulphuric acid, specific gravity 1.825.
   (11) One 17.5 cc. acid measure or dipper.
b. For testing cream—(additional equipment)
   (1) One 2 or 12 bottle cream weighing balance with weights.
   (2) One dozen 9-gram 50-percent test bottles —to be used instead of (2) above.

(Estimated but not accurate tests may be had by using 9-gram pipettes for measuring value of cream instead of the sensitive balances.)

Courtesy U. S D A.

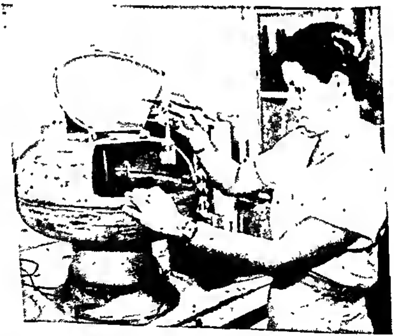
Fig. 17. Placing Milk in Test Bottles. The finger is held over the top of the pipette until pipette is placed in test bottle When the finger is removed the milk flows into the test bottle. To the milk in each test bottle is added 17.5 cc. of sulphuric acid

Sampling:—If the milk from a single cow is to be tested, the sample should represent an aliquot part of two complete milkings. In case the milk from a herd is to be tested the sample should be taken after the milk is thoroughly mixed. Mixing may be done by the pouring from one pail to another, or the use of a stirring rod. Since milk tests and quantities vary from one milking to another, slightly more accurate results may be secured by making a test of each milking.

Making the Test:—The test bottles should be marked or numbered on the etched part to identify the sample. The sample should be thoroughly mixed by pouring from one bottle to another. The pipette is filled by suction of the mouth until milk is past the

mark. The forefinger should be used as a valve by quickly placing it over the top of the pipette. The milk should then be emptied into the test bottle. One should blow into the pipette in order that all of the milk may be delivered into the test bottle. For accurate results, the temperature of the milk and sulphuric acid should be at 60° to 70° Fahrenheit.

Adding Acid:—The following directions should be followed in adding acid: (1) Measure 17.5 cubic centimeters of sulphuric acid, specific gravity 1.825—1.835 and add to the milk; (Caution—Extreme care should be exercised in handling acid. Acid spilled on hands, clothes, work table, utensils or other objects will burn them. Hands or clothes coming in contact with



Courtesy U. S. D. A.

Fig. 18. Placing Test Bottle in Centrifuge. Centrifugal action will separate the butterfat, sending it into the narrow neck of the bottle, where its percentage can be determined.

acid should be washed immediately with cold water.) (2) Mix the acid and milk by giving the bottle a slow rotary motion; (When the milk and acid are thoroughly mixed a dark chocolate or deep cherry red color will appear) (3) Allow the bottle to stand a few minutes.

Whirling:—The bottles should be placed in the centrifuge, taking care to balance the load in all cases. The centrifuge should be run for five minutes. In case hand centrifuge is used, one should be sure to conform to speed directions.

Adding First Water:—Clean, soft water at a temperature of 135° to 145° Fahrenheit should be used. The bottles should be filled to base of the neck. (In case water is hard, several drops of acid should be added to each quart of hot water. Care should be exercised in the addition.) The sample should be shaken again and placed back in the centrifuge and run for two or three minutes.

Adding Second Water:—Water of same temperature as mentioned above (135° to 145° Fahrenheit) should be added so as to bring the fat nearly to the 8 percent mark of the bottle. The centrifuge should then be run for one minute at full speed.

Reading:—The bottles should be set in a hot water bath, at a temperature of 130° to 140° Fahrenheit, for five minutes. If the test procedure has been carried out properly, the fat column will be a clear amber color and free of any charred particles or ash. To read one should place one prong of the dividers at the bottom of the fat column and the other prong at the extreme top of the fat column. The dividers should then be placed on the graduated space of the bottle neck with one prong at zero and the other wherever it will fall on the graduated space. The upper point reached is the reading for the percent fat. Each division on the graduated bottle neck represents 0.1 percent.

After the butterfat readings have been made, they should be recorded. Bottles should be emptied into glass or stone jars. Washing is best accomplished by first rinsing the bottles with water and then following with hot water containing a small amount of alkali washing powder. The use of a soft bristle brush assists in cleaning. Bottles should be rinsed with hot water and placed in draining racks.

Courtesy U. S. D. A.

Fig. 19. Measuring the Butterfat. The butterfat content of the sample of milk is measured by use of calipers. The butterfat rises to the narrow tube or neck of test bottle when the sample is centrifuged.

Cream Testing:—Cream is tested similarly to milk with the exception that 9 grams of well-mixed cream is weighed into the 50 percent test bottles. Care should be exercised in weighing exactly 9 grams in each bottle. A 9 cc. pipette is convenient to use.

Approximately 7.5 to 9 cubic centimeters of acid should be added to the cream in the bottle. The amount depends on temperature and fat content of the cream. Some testers add two to three cubic centimeters of water to cream prior to adding the acid. If this practice is followed, the amount of acid should be increased to 10 or 12 cubic centimeters.

Adding water and whirling is the same as for milk. After the cream test is made and the bottles are placed for five minutes in a hot water bath at 130° to 140° Fahrenheit, a few drops of glymol or red reader is carefully added to the top of layer so as to flatten the memiscus or curved portion at top of fat column. This makes it possible to read the percent fat accurately.

Dairy Arithmetic Problems:—The Babcock test bottles read in percent or per hundred, therefore, it is necessary to divide the percentage figure by one hundred, which will make 4.0 percent read 0.04 and likewise a reading of 3.8 percent would be written 0.038.

TABLE 6—THE TRUE AVERAGE TEST OF A HERD
(To illustrate how to find the true average test of a dairy herd, the production and butterfat test of ten cows for one month are given in this table.)

Cow Number	*Pounds of Milk*	*Test Percent*	*Pounds Butterfat*
1	600	4 0	24.00
2	400	6 0	24 00
3	1,500	3 0	45 00
4	700	3 5	24.50
5	500	4 0	20 00
6	1,000	3 1	31.00
7	450	4 2	18.90
8	1,200	4 0	48 00
9	300	5 8	17.40
10	1,050	4 6	48.30
Total	7700 Pounds	3 91% Av Test	301.10 Pounds

If the production of a cow is 25 pounds daily, and the milk tests 4 percent, then 25 times 0.04 equals 1.0 pound of butterfat.

While milk weighs 8.6 pounds per gallon, a ten-gallon can usually contains abont 85 pounds. If a can tests 3.8 percent, the quantity of fat contained would be equal to 85 pounds time 0.038 which equals 3.23 pounds of butterfat.

The true average test of a herd is obtained by dividing the total pounds of fat by the total pounds of milk produced by the entire herd for a month.

The true average test for the ten cows in the above table for one month is found by dividing 301.10 pounds of fat by 7700 pounds of milk, which is 3.91 percent. The arithmetic average which is found by adding the tests and dividing by 10 (number of cows), is 4.22 percent. This is inaccurate, due to the fact that the production of the cows varied widely during the month. Misunderstandings are often brought about due to the method used by some dairymen in calculating tests.

Calculating the Fat in Cream and Value:—A ten-gallon can of 40 percent cream weighs approximately 82.5 pounds. The quantity of fat in the can may be found by multiplying 82.5 by 0.40; thus 82.5 x 0.40 equals 33 pounds. If butterfat is worth 40 cents per pound a ten-gallon can would bring $.40 times 33 pounds, which equals $13.20.

Milk used for manufacturing purposes such as condensed milk and ice cream mix is usually purchased on butterfat basis or condensery formula which is based on the Chicago 92 Score butter market. This formula may appear somewhat complicated. Different markets usually make some changes to meet local conditions. The following buying plan is typical: Subtract 2 cents from the average wholesale price per pound of 92-Score butter in the Chicago market as reported by the

United States Department of Agriculture for the delivery period during which such milk was received, add 30 percent thereof, and multiply the resulting amount of 4.

For example, if Chicago 92-Score butter is 32 cents per pound, then

(1) .32—.02=.30;
(2) 30 percent of .30=.09;
(3) Adding .30 and .09=.39;
(4) .39×4=$1.56.

In addition butterfat differential adjustment is made for each one-tenth of one percent plus or minus 4 percent.

Market milk for the bottling trade is purchased on hundred-weight basis with a certain butterfat basis—usually four percent. A differential of 4 to 6 cents for each one-tenth of one percent plus or minus 4 percent is usually paid. For instance, if 4 percent milk is selling for $3.00 per hundred-weight with a 4-cent differential for each point, then 100 pounds of 4.1 percent milk would bring $3.04, while 100 pounds of 3.9 percent milk would sell for $2.96 per cwt.

SUGGESTIONS FOR STUDY

A. Questions and Problems

1. A herd produced for ten days the following amounts of milk and tests:

Pounds Milk	Butterfat Test	Pounds Milk	Butterfat Test
450	4.0	395	4.3
460	4.05	410	4.1
425	4.2	420	4.1
415	4.2	423	4.15
400	4.25	435	4.2

Courtesy U. S. D. A.

Fig. 20. Food Producers. Milk, produced by cows, is the best single food which nature provides. It has no substitute.

mins A and G. It contains other vitamins and minerals in variable amounts. Because milk reinforces the diet in so many different ways, it is the best foundation on which to build wholesome meals for the family.

No finer tribute was ever made to milk than that penned by the great scientist, Dr. E. V. McCollum of Johns Hopkins University. He said, "The people who have achieved, who have become large, strong, vigorous people, who have reduced their infant mortality, who have the best trades in the world, who have an appreciation of art, literature, and music, who are progressive in science and every activity of the human intellect, are the people who have used liberal amounts of milk and its products."

Milk, Nature's Most Nearly Perfect Food:—Scientists, nutritionists, and other authorities are agreed that milk is our most complete food. Milk contains vital carbohydrates, proteins, fats, vitamins, minerals, and water necessary for the health and maintenance of the human body. Consumer's Guide (U. S. Department of Agriculture publication) shows the total production

of milk in 1936 to be 49,306,000,000 quarts with the consumption of every 100 quarts as follows:

33.5	quarts	consumed	as	fluid milk
8.3	"	"	"	cream
4.1	"	"	"	evaporated milk
3.4	"	"	"	ice cream
40.7	"	"	"	butter
6.1	"	"	"	cheese
2.6	"	"	"	animal feed

Early History of Dairy Products:—The cow has long been associated with the history of civilization. Many references to dairy products are found in the Bible as in Judges 4:19 "And he said unto her, Give me, I pray thee, a little water to drink; for I am thirsty. And she opened a bottle of milk, and gave him drink, and covered him."

The breeds of dairy cattle in America came from Europe. Holland and Switzerland are the countries in which the greatest development in dairying first took place. Permanent colonies were not established in America until cows were brought from England.

Need of Milk in Human Diet:—Appetite is no longer a satisfactory guide to eating properly because of changes in food habits, variety of foods and the removal of important nutrients in processing. Conscious effort must be made to select a combination of foods which is not only pleasing but which will provide all of the essentials of properly balanced meals to make up an adequate diet. Such a combination of foods should contain the following:

(1) protein for building and repairing body tissues;
(2) carbohydrates and fats for required heat and energy;

What is the total amount of butterfat? Average test? Value of milk at $3.00 per hundredweight for 4 percent fat with 4 cents per tenth of one percent differential?

2. Mr. Jones sold the local condensery 4500 pounds of 4.5 percent milk during the month. What was the amount of his check based on 15 cents above Chicago 92 Score butter at 35 cents, and with a differential for each point of 3 cents plus or minus 3.8 percent. The hauling charge was 25 cents per hundred-weight. What was the amount of Mr. Jones' check?

3. Mr. Brown shipped two cans of cream to the local creamery. One can weighed 40 pounds and tested 38 percent and the other weighed 41 pounds and tested 40 percent. What was his cream check with butterfat price of 32 cents per pound?

B. Activities

1. Secure samples and weights both of night and morning milkings of each cow on your home farm.

2. Test above for butterfat and make calculations of fat production for each cow.

C. References

Chemical Testing of Milk and Cream, Bulletin No. A-12, Bureau of Animal Industry, U. S. D. A.

The Cow Tester's Manual, Miscellaneous Publication No. 359, U. S. D. A.

Chapter IV

VALUE OF MILK IN THE DIET

Milk is the best single food which nature provides. It is the one food for which there is no satisfactory substitute.

Science has begun within the last few years to examine milk, to look inside the bottle, inside the milk itself and see what is there. Science has found that milk, more than any other single food, meets the nutritional needs of the body.

According to standards set by nutritionists, a quart of milk furnishes the following percent of your daily nutritive requirements: Calcium, 100%; Vitamin G, 97%; Phosphorus, 69%; Vitamin A, 49%; Protein, 48%; Vitamin B, 42%; Energy, 22%; Iron, 16%; and Vitamin C, 16%.

Everybody wants to be thrifty when buying foods for the family diet. One good way to judge whether or not a particular food is economical is to find out how much real "food value" it supplies for the amount of money it takes from one's food budget. The Bureau of Home Economics states that milk and dairy products are truly economical when judged in this way.

One quart of milk will furnish all the calcium needed each day, two-thirds of the phosphorus, one-fourth of the vitamin A, and all of the necessary riboflavin (Vitamin G).

Nutritionists claim that approximately one-fifth of the urban family's food budget should be spent for dairy products.

When taken in suitable quantities, milk has no equal among foods as a source of calcium. It is also a dependable source of phosphorus, proteins, and vita-

Courtesy Ext. Ser. U. S. D. A.

Fig. 21. Foods We Need. The consumption per capita of milk in the South is lower than for any region in the nation. This is due in part to the fact that there is a large per cent of the farms in the South (ranging from 14.6% in Oklahoma to 56.7% in Florida) without cows. See Table 3, Chapter I.

(3) mineral elements for such purposes as building bones, teeth, and blood, and for regulating body functions; and

(4) Vitamins for promoting growth and health.

Milk supplies more of these protective food factors necessary in a normal diet than any other food, and supplies them more cheaply. Milk in some form might well furnish one-fourth of the total calories used by the average American family. In terms of money value, from one-fifth to one-third of the allowance for food should be spent for milk and its products.

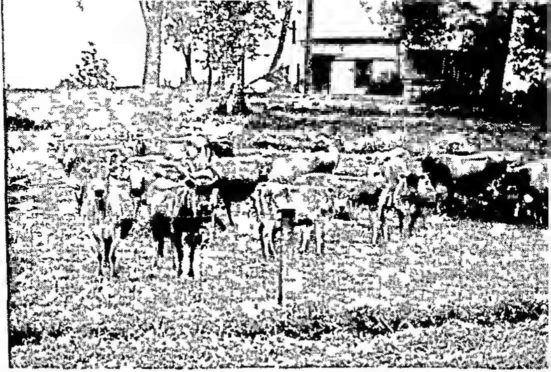
Authorities of the National Defense Commission have stated that one-third of the people in the United States are living below the "safety line" of proper diet. The United States has the best food supply in the world, yet there is a famine among this large number of Amcricans for lack of precious vitamins and minerals. Food deficiency diseases weaken people and render them physically unfit. This weakened condition is not caused only by insufficient food, but by the continued use of the wrong foods and by omitting the protective foods—milk, fruits, vegetables, and eggs. Milk heads the list as the most essential protective food.

"The lack of common-sense knowledge of nutrition," says Henry A. Wallace, former Secretary of Agriculture, "even among many well-to-do people in the United States is appalling. There are many kinds of 'hidden hungers' which the experienced person can read in the faces and attitudes of the undernourished. Peaked faces, bowlegs, and shaky nervous systems are only a few of the manifestations."

Dr. H. C. Sherman of Columbia University says that 50 percent of our food calories should come from milk and milk products, fruits, vegetables, and eggs. Less than one-third comes from these sources at the present time. McCollum, another authority, claims lib-

Courtesy Ext. Ser. U. S. D. A.

Fig. 22. Milk Powder. Much milk is consumed in this form. Here is shown skimmed milk being made into skim-milk powder. As the milk powder comes from the machines it is bagged.



Courtesy Ext. Ser U. S D A

Fig. 23. Contented Cows. What wouldn't be contented in a lovely setting like this?

eral amounts of milk and its products should be used in the diet to offset deficiencies of the highly processed cereal foods which are principal sources of energy in our diet. He is of the opinion that a good diet should include the equivalent of a quart of milk every day throughout life. Milk is a protective food, the minerals keep the teeth in repair and the vitamins protect the body from certain diseases.

Milk is an economical food and can be produced economically on every Southern Farm.

The average consumption of milk in the United States is 10 to 20 percent less than food requirements claimed by dietitians to be desirable for health and safety. The consumption for the South as shown by Table 8 is much lower than the general average of the nation. Thus dairy development is advisable in the South from the health as well as the economic standpoint.

The North Carolina Extension Service estimates the minimum amount of milk necessary for a balanced diet to be at least 146 gallons per capita per year.

Our national milk consumption varies in sections and upon business conditions. Table V shows this very conclusively.

TABLE 8—U. S. MILK CONSUMPTION PER CAPITA
(By Regions in quarts)

	North Atlantic	North Central	South Atlantic	South Central	Western
1924	173 2	162.8	113 2	116 4	158.0
1927	178 0	169.6	110 4	118.4	158.8
1930	179 6	161.8	122.4	130.4	167.2
1936	173.6	156.0	116 4	114.4	141.6

Source: Milk Facts, Milk Industry Foundation, November 1940.

The figures in Table 8 show that the South Atlantic and the South Central states are lowest in milk consumption per capita. Approximately 10½ quarts of milk are required to make a pound of butter and 4½ quarts for a pound of cheese. Our national consumption of butter per capita is estimated to be 18 pounds, cheese 6 pounds, and ice cream 2.2 gallons.

SUGGESTIONS FOR STUDY

A. Questions and Problems

1. Why is milk the most nearly perfect food?
2. Is there any reason why this product cannot be available for every farm family?
3. Is health wealth?

B. Activities

1. Make a study of the great races and nations of the world regarding their food habits.

C. References

Milk as a Food Throughout Life, Bulletin 447, Agricultural Experiment Station, University of Wisconsin, Madison.

Food and Life, Yearbook of Agriculture, 1939, U. S. D. A.

The Newer Knowledge of Nutrition, The Macmillan Company, New York.

Chapter V

GENERAL BREEDING PROBLEMS AND PRACTICES

There are about 26,000,000 cows that are used for milking purposes in the United States. A very large majority of these cattle carry one or more crosses to purebred animals. Only about five percent of the milk cow population is purebred. Therefore, a very large percent of the milk produced is from grade cows. This does not mean, however, that the purebred cattle are of little importance to the dairy industry. The good that is in the grade cows has come from their purebred ancestors.

Many grade herds have been developed by the use of several generations of purebred sires. They carry a very large percentage of the blood of purebreds, but because it is not 100% they will never be entirely purebred. Some of these good grade herds produce equally as well as many purebred herds, however, the better bred purebred herds lead in production.

Breeds:—The breeds were developed in early times by the keeping of a limited number of animals in a certain locality where all cattle ran together in common pastures. Probably no breeding or production records were kept, but selection was based on keeping those animals that did the best under the existing conditions of the survival of the fittest.

The bulls that were kept, necessarily, carried some of the same blood as did many of the females. This caused a great deal of close breeding, referred to as line breeding or inbreeding. From this system certain

Courtesy Stewart Rivers, Sherwood Forest Farm

Fig. 24. Results of Good Breeding. Here is shown at the left, Rockingham Darling 303508, a Foundation Cow with her seven daughters. Their records of production are as follows: Rockingham Darling—14583 milk, 638 fat, Class A. Daughters: (1) Baby calf; (2) 15659 m 647 f class BB; (3) 11704 m 577 f class F; (4) 18213 m 921 f class AA; (5) 11037 m 513 f class G; (6) 14380 m 692 f class AA; (7) 11459 m 548 f class GG.

characteristics were developed in type, color, and their value for milk or beef.

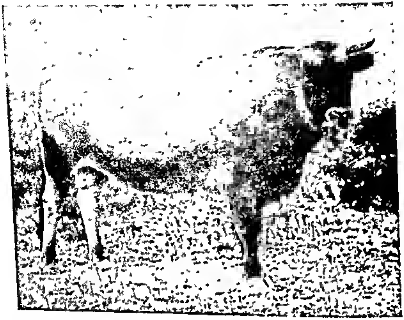
Occasionally, through barter or conquest, some new blood would be added to the cattle in these small communities. From the many types of cattle grown, especially in western Europe, there were developed a few outstanding breeds. They were imported into America, and today we have five major dairy cattle breeds.

These breeds have been bred and selected for certain characteristics such as type, color, quality and quantity of milk. Their development includes many, many cattle generations. There are great variations among purebred cattle, but the progress which has been made with them is proof that any dairyman, whether he has grades or purebreds, should select a breed and stick to it. The improvement or maintenance of the quality of a herd should be accomplished by the use of a succession of purebred sires.

Definitions:—A purebred animal is one whose ancestors were all of the same breed and were pure. In the United States, a purebred is considered one that traces in all its lines to animals that were imported from the native home of the breed.

A registered animal is a purebred that has actually been recorded in the herd books of the breed association, by registration name and number. There are great numbers of purebred dairy animals that are not registered. Some of these cases are due to the failure of the owner to apply for registration. Others cannot be registered due to the fact that sufficient records of breeding dates, identification of calves, and other information have not been kept.

Scrub animals are those with no special breed characteristics. They are often referred to as native, unimproved cattle with little producing ability.



Courtesy Ext. Ser. U. S. D. A.

Fig. 25. Good Bulls Essential. Good bulls must be used if high producing herds are developed. Great care should be exercised in selecting herd bulls.

A grade animal is one that carries at least one cross to a purebred animal. It receives 50% or more of its inheritance from one or more purebred parents of the same breed. A first cross grade carries 50%, a second cross 75%, a third cross 87½%, and a fourth cross 93¾%. This percentage of pure blood continues to increase but will never reach 100%, and therefore will not reach a point where the animal can be registered. Animals carrying a high percentage of pure blood are called high grades. They are the ones that constitute most of our good commercial herds.

A cross-bred animal is one produced by the mating of a purebred animal of one breed with a purebred of another breed. Cross breeding is discouraged in dairy cattle production as it tends to break down the purity

of the breeds that has been preserved over many generations.

Pedigree:—A pedigree is a record of ancestry, shown in graphic form. Pedigrees are seldom written, except for purebred animals. Information on other animals is usually not available in complete form. The dairy cattle breed associations keep a complete record of all parentage as well as all offspring of registered animals. These records make up the herd registry. A pedigree should include such information as production records, transmitting records, show ring records, and relationship.

EXAMPLE OF PEDIGREE

Pedigree of Christmas Pogis Agathe 1259376

Sire

Mary's Pogis of Andrewsia 303442
Classified Good plus
D H I A Proved Sire
25 daughter-dam pairs

	Milk	Test	Fat
Daughters	8325	5 6	467
Dams	7766	5 4	416
	+559	+ 2	+51

Paternal Grandsire

Pogis 99th of Hood Farm 54th 169653
A J C C silver medal sire
18 D H I A daughters average 7781 milk 5 6 per cent 432 fat

Paternal Granddam

Mery of Andrewsia 577478

Milk	Fat	Days	Age Yr
8011	499	305	5
10510	580	365	8
8049	466	303	7
8750	507	364	8
10243	563	362	9
8138	471	327	10

Dam

Christmas Eve Agatha 1026252
Classified Good

Milk	Fat	Days	Age Yr	Age Mo
8576	506	355	2	3
8859	492	328	3	5
9387	551	342	4	6
8122	481	323	5	6
8910	524	341	6	6

Maternal Grandsire

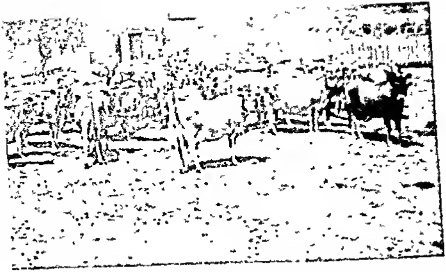
Rosalie's Interested Owl 259509
A J. C C Tested sire
19 daughters average 9034 milk
5.39 percent 487 fat

Maternal Granddam

Agatha of Andrewsia 748177
Classified good plus
A J. C. C gold medal

Milk	Fat	Days	Age Yr.	Age Mo.
11511	716	365	5	0

Eleven lactations total 6713 lbs fat



Courtesy Ext. Ser. U. S. D. A.

Fig. 26. Outstanding Jersey Herd. Good breeding practices were followed in developing this herd which is owned by the Shelton Brothers Dairy Farm, Brown County, Texas. This herd ranks high among major herds on official test.

The greatest emphasis should be given to the animals close up in the pedigree. Those in the first and second generations should receive most of the consideration, as compared to those in the third and fourth generations or farther back. An animal in the first generation, that is the sire or the dam, exerts four times as much influence in the inheritance of the animal as one in the third generation, and eight times as much as one in the fourth generation.

A pedigree, in itself, is not a guarantee of performance, as poor individuals of type and production are found in every breed. However, where there is sufficient information given in the pedigree, some estimate of the probable inheritance can be determined. It gives some added information, over and above what can be had by just seeing the animal.

Establishing a Herd:—To develop a purebred herd it is, of course, necessary to start with purebred animals. Unless one has had experience in handling dairy cows, it may be best to begin with grades, since it requires experienced management to handle high pro-

ducing cows successfully. A well selected registered sire should be used from the beginning. As experience is gained, registered females may be added to the herd.

In securing registered animals for a foundation for a future registered herd, desirable animals from the standpoint of type and of satisfactory producing ability should be selected. This is true whether it be for a small herd or a large one. The amount of capital available and the time one expects to take to get into the purebred business will determine, in a large way, what can be purchased. Usually the purchasing of calves from a well bred herd, that has a substantial year after year production record on the entire herd, is a means of starting with good animals without too great an outlay of capital.

If somewhat more capital is available, bred heifers offer a quicker method. In some cases, immediate milk production is needed and cows are the most desirable buy. It should be of interest and great encouragement to beginners to know that some of the good registered herds in this country were started in a very small way and without a great outlay of capital. Good foundation animals are necessary. It is also essential for a person to like good cattle and to be capable and willing to develop them.

Breed *Associations:* — Breed associations have played an important part in the development of dairying. In addition to keeping herd books, they have kept complete records of the performance of animals within their breed. The herd books comprise valuable reference material on the respective breeds.

A student may secure valuable information and literature by writing to any of the following associations:

American Jersey Cattle Club, Columbus, Ohio.

Courtesy U. S. D. A.

Fig. 27. A Future Herd. Good herds are developed from good heifers such as these. Note that these are on good pasture. Heifers should be fed an abundance of roughage.

American Guernsey Cattle Club, Peterborough, N. H.

Holstein-Friesian Association of America, Brattleboro, Vt.

Ayrshire Breeders Association of America, Brandon, Vt.

Brown Swiss Cattle Breeders' Association, Beloit, Wis.

Breeding Practices

Age of Breeding Heifers:—The age of breeding dairy heifers depends upon the breed and the development of the individual. The length of time between service and delivery of calf is usually 280-285 days, with an average of 283 days, or nine months and nine days. This is called the gestation period. First calf heifers usually calve a few days sooner than older cows.

The Beltsville Experiment Station has obtained good results from well grown Jersey and Holstein heifers which have freshened soon after 2 years of age. Stunted or poorly developed heifers should not be allowed to calve this early. Contrary to general opinion,

the development and carrying of the fetus is not as severe on the heifer as is the effect of the early lactation period.

The average breeding age for the four major breeds is as follows:

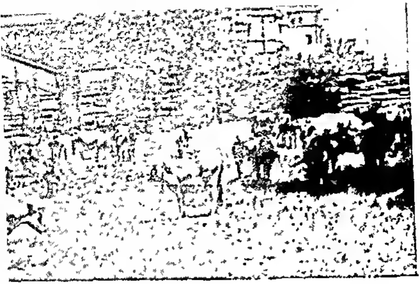
Ayrshire	17-21 months
Guernsey	16-19 months
Holstein	17-21 months
Jersey	15-17 months

Inbreeding:—Inbreeding is the breeding together of closely related individuals, for instance such as brother to sister, sire to daughter, or son to dam. Judicious inbreeding may be depended upon to help in bringing about uniformity and increased production which should be the aim of every breeder. Inbreeding is a fine tool for the experienced breeder to establish certain hereditary qualities. However, the weak points or characteristics have an equal opportunity to develop as well as the desirable features. It is not wise for the average breeder or dairyman to carry on inbreeding. Even though some animals might be especially de-

PEDIGREE ILLUSTRATING INBREEDING

- Quail Roost Lucky Maxim 266534
  - Quail Roost Lucky Strike 227993
    - *Maxim of* Burkeville 129366
      - High Point Prince Maxim 104016
      - Foremost's Patience 149894
    - Maxim's Francine 349830
      - High Point Prince Maxim 104016
      - Beaux Francine—251918
  - Quail Roost Maxim's Ann 449551
    - High Point Prince Maxim 104016
      - Maxim of Linda Vista 42270
      - Cavalier's Helen—65648
    - Quail Roost Ann Spotswood 291548
      - Spotswood Majesty 121104
      - Little Ann of Open Country 166421

This pedigree shows inbreeding. Note that High Point Prince Maxim appears three times in the pedigree.



Courtesy U. S. D. A.

Fig. 28. Outstanding Herd. A part of the splendid Biltmore herd, Asheville, N. C., is shown grazing in an abundant pasture growth. A portion of the main building of the famous Biltmore Estate is shown in the background.

sirable, the average breeder usually will not do the amount of culling that in most cases must accompany inbreeding in most lines.

Line Breeding:—Line breeding is a milder form of inbreeding among related animals without having the

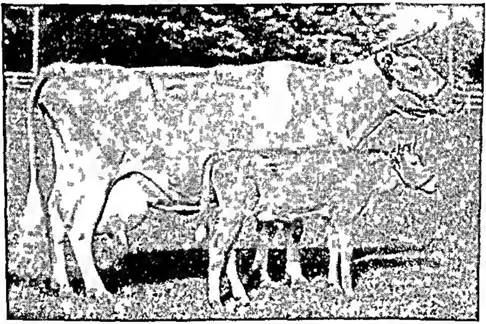
PEDIGREE ILLUSTRATING LINEBREEDING

- Blonde's Famous Lad 368886
  - Blonde's Golden Lad 215418
    - Imp Blonde's Golden Oxford 200863
      - You'll Do's Fontaine 150686
      - Bright Blonde P. 17450 H. C.
    - Pretty Emma You'll Do 419785
      - Imp. Oxford You'll Do 111860
      - Combination's Pretty Emma—389010
  - Potentate's Famous Wonder 876410
    - Blonde's Potentate 241071
      - La Gloire Cid 189503
      - Bright Blonde P. 17450 H. C.
    - Wonder Moon 45[illegible]
      - Brampton Beauty Heir 7750 CJCC
      - Brampton Wonder Star 456909

This pedigree shows linebreeding. Note that this animal traces twice to Bright Blonde.

relationship too close. This may be illustrated as breeding a bull to his granddaughter. Famous families, especially among Jerseys have been developed through this method of blood concentration. This is the most popular system of breeding. It offers advantages of concentrating desirable qualities with less chances of producing undesirable characteristics. The results of line breeding do not require as much culling as inbreeding.

Time of Year for Freshening:—In order to secure efficient milk production, it is desirable that a cow produce a calf each year. The natural time for cows to



Courtesy American Guernsey Cattle Club

Fig. 29. Guernsey Cow and Her Eleventh Calf. This Guernsey cow, Shuttlewick Mirth, has just celebrated her twenty-first birthday. She has eleven registered sons and daughters and 201 grandsons and granddaughters She is shown here with her eleventh calf—Douglaston His Royal Highness.

freshen is in the spring. This practice fits in with some farming conditions, where cows are maintained largely by grazing and no extra care is taken to provide feed for fall and winter production. This is an inferior type of dairying. Milk and its products are needed the year

round by the farm family and the consuming public. Consequently the progressive dairyman will breed cows to freshen at periods of greatest market demands and at a time when prices are highest, which is usually during the fall and winter months.

Herd improvement records show that fall freshened cows produce about ten percent more milk and butterfat than cows that drop calves in the spring. Cows naturally milk well during the early part of their lactation period. When those that freshen in the fall are turned to pasture in the spring, they get the advantage of this milk producing stimulus about the middle of their lactation period. When the short grass, hot weather, and flies affect them most, they are near the end of their lactation period.

Fall freshening offers other advantages, since at this season a dairyman usually has more time to give to his cows. Then, too, the fall calf is ready to go on early pasture in the spring.

It is not advisable to make drastic changes in breeding periods as shy breeders are likely to be developed if too many heat periods are allowed to pass without breeding, however, it can be partly controlled. A record of breeding dates should be kept. This lets the dairyman know when to turn the cow dry and when she is due to calve. A record of calving dates is essential because it is necessary to know when to again breed the cow, as well as to know the age of the calf, and later the time at which to breed it.

Freemartin:—Abont one percent of all dairy calves born are twins. A part of these are of mixed sex, that is, in the pair there is one heifer and one bull calf. The heifer of the mixed pair is usually sterile and will not breed, and is called a freemartin. In cases where the two calves are born in separate afterbirths, the

female should be normal and breed. This represents about eight percent of the cases. Otherwise the hormones from the male, during the period of development, interfere with the normal development of the reproductive organs of the female. In mixed sets the male is normal; and where they are of the same sex both calves are normal as far as breeding is concerned. Twin calves are smaller, on the average, than single births and are harder to raise. Twins in cattle are not usually desirable.

SUGGESTIONS FOR STUDY

A. Questions

1. What are the advantages of inbreeding? Dangers?
2. Why is fall freshening of value to Southern Farmers?
3. There are two ways of getting into the dairy business, buying into it and growing into it. Which is the best method? Why?
4. Is the pedigree satisfactory proof that the animal will be a successful producer?

B. Activities

1. Make a field trip to a farm of grade cows and to one where purebreds are kept. Note milk production and also observe uniformity of the herds.
2. Make a pedigree study of any outstanding cow.

C. References

Dairy Cattle and Milk Production, Eckles, C. H.; Anthony, E. L.; and Palmer, L. S. The Macmillan Company, New York.

Dairy Cattle Breeds, Farmer's Bulletin No. 1443, U. S. D. A.

Chapter VI

THE HERD SIRE

The herd sire is the most important animal in the dairy herd as far as the future herd is concerned. For many years the axiom "the sire is half of the herd" has been used by breeders and dairymen.

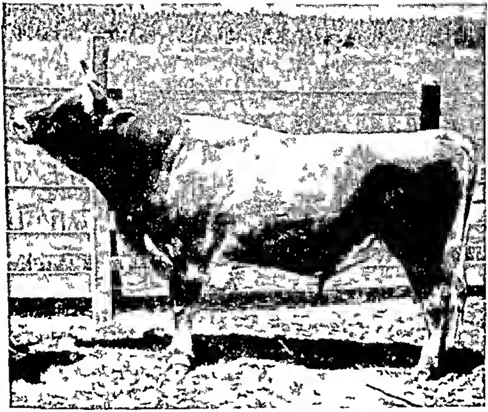
The bull may easily sire anywhere from twenty to fifty calves per year. Under careful handling this may be increased considerably. With artificial insemination the number may become very large. On the other hand, the best that may be expected from a cow is one calf per year. The average is less than one. On an average one may expect only five calves during the lifetime of a cow.

While each calf receives one-half of its inheritance from the sire and one-half from the dam, the sire transmits its characteristics to many more calves than does the dam. It can be readily seen that if the average production of the future herd is to be increased over that of the present herd, the herd sire is of utmost importance. The proper selection of a herd sire is of special importance to the young man starting a dairy herd because his success depends to a great extent on the kind of cows that he raises.

Purebred Sires Raise Production:—Increased production can be developed to a certain level by careful management, intelligent feeding, and culling the low producers. However, if further increase in production is attained, it must come from cows that have an inherent ability for secreting a large quantity of milk If this higher producing ability is to be developed through the cows in a specific herd, the new inheri

tance must be brought in through the bull In selecting a new herd sire, one should first get a bull of the breed with which he has already started and should consider only one that is registered However, these two factors are not sufficient

A bull under consideration may fall into one of three classes, namely, (1) a proved bull, (2) a partially proved bull, or (3) an untried bull



Courtesy Ext. Ser U S. D A

Fig 30 Superior Animal Well bred bulls (like the one above) are essential for the breeding of high producing dairy cattle

Proved Bull:—A bull is considered proved when he has five or more daughters that have completed a lactation period. This gives proof of just what level of production he has transmitted to his daughters There are several methods by which these records

may be used to calculate the proof. The Bureau of Dairy Industry, U. S. D. A., has available more records for proving herd sires than any other agency. This agency uses dairy herd improvement association records. The method of proof is to compare the records of at least five daughters of a bull with the records of the dams of the daughters. Though the minimum number is set at five, the more daughters on which recorded production has been kept and the greater the number with more than one record, the more dependable is the record for the bull.

Since the records on the daughters and dams may not be made at the same age, they are computed to an equal age basis by the use of constant figures called conversion factors.

Other agencies use different methods for calculating the proof on a bull, but the same principles are maintained. The American Jersey Cattle Club officials average the register of merit and herd test records of not less than ten daughters of a bull. They do not make dam-daughter comparisons. Officials of the Holstein-Friesian Association use their herd test records and calculate a dam-daughter comparison on at least six pairs. The American Guernsey Cattle Club officials have prepared proof information on Guernsey bulls by using ten pair comparisons.

Through all the systems of proving, some bulls are found to be extremely valuable sires. They may raise the level of production of their daughters over the production of the daughter's dams, or they may maintain a high level of production when bred to high producing cows. The dairy industry is searching for such sires. After they are found through some system of proving, they should be kept in service for their entire period of usefulness. Their useful life can be extended by proper handling and feeding, and their extensive use

Courtesy Ext. Ser. U. S D. A.

Fig. 31. Herd Bulls. Shown above are three herd bulls on the farm of Lonie Usry, Etowah County, Alabama.

can be brought about through proper cooperation of herd owners.

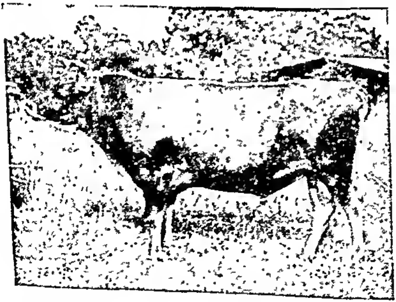
On the other hand, there are bulls whose proof shows that they are not desirable. They may either sire daughters that produce less than their dams or they may not be able to increase production over that of low producing cows. Such bulls should not be maintained in service. The sons of such bulls are not desirable and should not be retained. If they are kept for breeding purposes, a large number of their daughters will have to be culled.

The sires that can raise production to a desirable level or can maintain a satisfactory level form the basis for continued improvement. However, before deciding definitely to keep a bull for breeding purposes a further study other than just the records should be made. Answers to the following questions should be obtained: (1) Are his daughters of desirable type? (2) Are they the kind of cows that can be expected to remain in the herd over a long period of years? (3) Do

they improve with their second and third calves over what they produced with their first calf? If the answer to all of these questions is yes, then the sons of these good bulls should be raised for herd sires.

In making a study of production proof and other transmitting abilities of a bull, the conditions of environment under which his daughters were raised and milked should be carefully considered. This should show whether the production information is a true indication of the inheritance from the sire, or whether it reflects differences in care and feeding.

A wide application of the value of good breeding, careful management, and feeding according to production—in order to produce more milk and butterfat and a greater net profit—is shown by the records of herds that are included in the dairy herd improvement



Courtesy Ext. Ser. U. S. D. A.

Fig. 32. Another Herd Bull. This picture of Pebble Bright Gilbert—a Jersey bull—was made when he was 2½ years old. He is owned by a Wilkes County, Georgia dairyman.

associations. The average production of all milk cows tested for production in the dairy herd improvement associations in the United States was 346 pounds of butterfat in 1945. While feeding, management, and culling account for a portion of this high production, the consistent use of the herd sires that have inherited high producing characteristics and that can transmit these characteristics to their daughters plays a large part in this high production.

Despite all that is known and taught about the advisability of using a proved bull, very few are in service. This is a deplorable situation. It comes about, however, by a combination of factors. In most small herds only one bull is maintained. When he has daughters that are ready to breed, he is too often sold to the butcher and is replaced by a young bull. Then, too, at about this age a bull usually becomes unruly. Without the protection of a safety bull pen and lot, the owner as well as a prospective buyer does not care to handle a mature bull. For these reasons a large percentage of the herd sires are butchered before it is known whether they are desirable or not.

A bull is usually six or seven years old or older before he is proved. This can readily be calculated. A bull will be a year old or older when first used, and must at this age be used lightly. He will be close to two years old when his first calf is dropped. He must have at least five daughters to prove him, therefore, on the average he will have to sire at least ten calves to have five daughters to prove him, since the sexes are about equally divided. The bull may be three years old by the time this number of his calves are dropped and in small herds probably older. If one adds to this the length of time necessary for growing the heifers up to freshening and then ten months to a year for them to make

their records, the bull will usually be six to seven years old.

The four-year-old bull (the age at which so many are discarded) usually does not have daughters in milk, however, he does have yearling daughters. While this does not give any performance information, it does indicate the type and development in his daughters. This is of value when added to pedigree information.

The bull calf or untried bull constitutes by far the largest means of herd sire replacements. The breeding worth of such bulls can be enhanced by doing the following things: (1) by carefully selecting pedigrees, (2) by selecting bulls from herd sires that are siring desirable cows, (3) by selecting bulls from cow families that have been able to remain in the herd as good producing brood cows that transmit desirable qualities—including acceptable production from dam to daughter. This may be illustrated by a pedigree description shown below.

Bull Calf	A proved sire, whose daughters average above the level of the cows in the herd in which the son is to be used, and are of desirable type.	A proved sire of desirable daughters, both records and type.
		A cow with good production and with daughters equally good.
	A dam with several records above the average of the cows in the herd in which the son is to be used. She is of satisfactory type, also has one or more daughters with acceptable records and type.	A proved sire of desirable daughters, both type and records.
		A cow with good production and with daughters equally good.

A bull calf with a pedigree such as described above will lessen the chance of using a bull that will "tear down" production.

If the sire is a good proved bull—with daughters of desirable type and characteristics—there is every

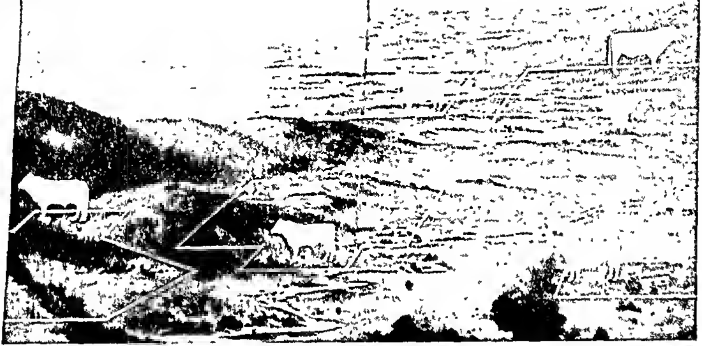
reason to believe that he will transmit these same good qualities to his sons. If the dam is a good producing daughter of a desirable proved sire, she can be counted on to transmit good inheritance to her sons much more completely than if she were a good producing daughter among a number of inferior half sisters. Also, if she has more than one record, it indicates her year in and year out producing ability. If she has daughters in production, they serve as the best indication of what she will transmit in the way of inheritance to her sons.

Age of Breeding:—At six months of age, bulls and heifers should be separated. Young bulls 12 months of age may be used for light service. Until they are 18 months old, they should, however, be limited to only a few cows.

At 2 years old, a bull should not serve more than 2 to 3 cows a week and not more than 60 to 80 during the year.

It is not advisable to allow the bull to run with the herd. If he does, some heifers will most likely be bred too young, and it will also reduce the number of cows that the bull can serve. This is due to more services per cow when the bull is running with the herd. This practice also prevents the development of a system which will provide breeding records. It is very desirable to know when cows and heifers are due to calve.

Good Sires Increase Production:—The increased production of all breeds is attributed to the selection of good sires and cows. Records of breeders and herd improvement associations show many tangible examples of increased milk and fat production due to a well bred bull. It must be admitted that all purebred sires do not have the ability to transmit desirable characteristics. However, the Bureau of Dairy Industry (U. S. D. A.), from records compiled of cows in dairy-herd improvement associations from all parts of the United



Courtesy U. S. D. A.

Fig. 33. A Cooperative Dairy Bull Association. This is an organization formed by dairy farmers to facilitate the joint ownership, use, and exchange of dairy bulls. Its primary objects are to enable the members or herd owners to (1) obtain the services of better sires than they could obtain as individuals, (2) to increase production in their herds, and (3) to carry on a long-time breeding program of herd improvment. The use of good proved bulls—bulls that have demonstrated that they can increase production in their female progeny—is the surest, quickest, and least expensive way to build up a high-producing herd.

States, found that average cows mated with purebred sires produced daughters with greater production records than their dams.

Table 9. A Proved Sire Record

(*This is a good Dairy Herd Improvement Association Proved* Sire Record of V. P. I. Bess Burke O'Dione Hale 654536. It is a 21 dam-daughter comparison. The record is for a period of 305 days—mature equivalent basis.)

	Pounds of Milk	Pounds of Fat
21 Daughters average	11,758	401
21 Dams average	11,500	394
Difference	+258	+7

(The sire of the 21 daughters was capable of slightly increasing an already high level of production).

Extending the Use of Good Sires

There are various methods of extending the use of good sires, and thus making desirable bulls available to more people. Individual arrangements may be made whereby two dairymen can exchange bulls of the same breed after about two years of service. This is a very feasible arrangement if both have safety bull pens in which to keep the older bulls without danger of handling them. This method as well as some to be mentioned later makes it possible to retain the bulls until they can be proved.

Cooperative Bull Associations:—Many dairy farmers have found that they can take care of their herd sire problem more satisfactorily by cooperating with each other. There are several cooperative dairy bull associations in operation. They are made up of dairymen who are using the same breed.

There should be a sufficient number of dairymen to use from three to five bulls. One herd or a number of small herds located close to each other may use one bull. This one herd or group of small herds is called a

block of the association. One bull is needed for each block. In securing the bulls each member of the association is assessed a certain amount per cow owned. This is to take care of the expense of buying the bulls and to set up a cooperative association for joint ownership. All the bulls belong to the association and not to any one individual.

When a bull must be replaced for any reason, all members pay for the replacement according to the number of cows that each owns. In the better associations, certain requirements are set up for each member, such as having (1) each herd tested yearly for tuberculosis and Bang's disease, (2) each member join a dairy herd improvement association, and (3) each member build a safety bull pen.

In setting up an association the members enter into an agreement as to how long a bull will remain at

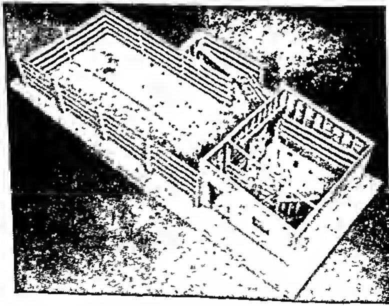


Fig. 34. Model of Safe Bull Pen. Note the stall, feed alley, lot, breeding chute and safety gate at breeding stall. This model shows the roof off the stall.

any one farm. This period is usually one or two years. At the end of this period, the bulls are rotated in a pre-scheduled order. By following this procedure, the bulls are kept until they are proved and the desirable ones can then be used extensively. This system encourages the proving of all bulls and the greater use of proved sires, rather than the usual quick turnover and replacement with young untried sires.

Artificial Insemination:—In more recent years, the use of some proved sires and well selected sires has been extended enormously by the use of artificial insemination. This method entails the collection of the semen from the bull and the use of only a small portion of the collection for the insemination of each cow. To be very effective, it is necessary to have an organization of a large number of dairymen and the use of a few especially good bulls.

Handling the Bull:—Bull calves should be trained to lead at an early age. This training is of special value in showing and handling. A copper ring 2 to 2½ inches in diameter should be placed in the bull's nose when he is around one year old. Sometimes rings wear out or are pulled out. They should always be replaced. A ring larger than 2½ inches in diameter should be used for larger bulls. Ringing is not difficult if a trocar and cannula are availale for use to make the hole through the nose. Some rings are self piercing. A staff is a requisite in handling.

It is advisable to handle the bull in a safe manner and not take chances. One should never tie up a bull directly with the ring. A rope placed around the horns and run loosely through the ring is satisfactory. This prevents the danger of a bull tearing out his nose. If the bull is dehorned a strong halter with the lead through the ring is all right for tying.

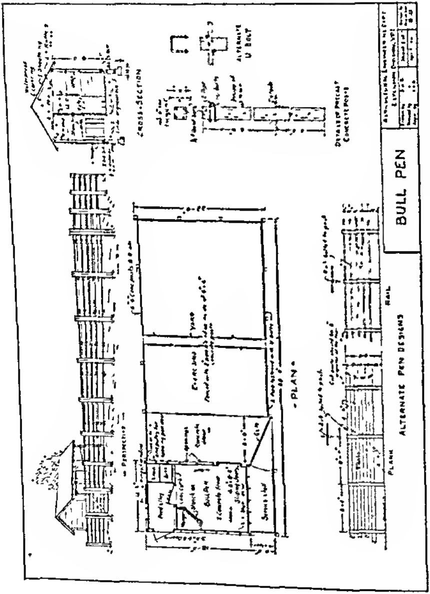


Fig. 35. Bull Pen. Here is shown a detailed drawing of a safe bull pen.

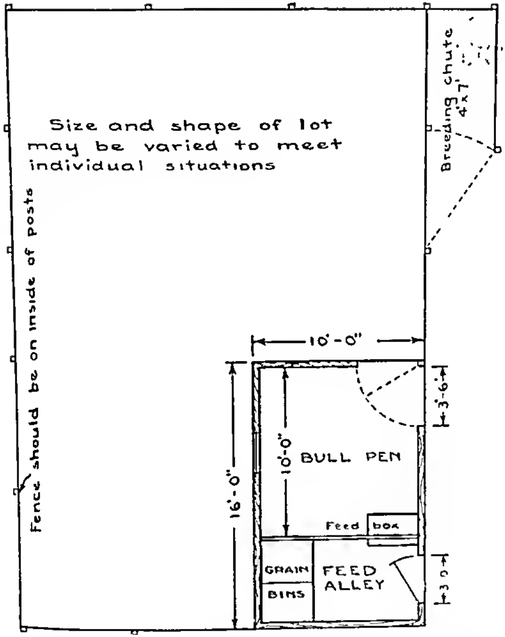
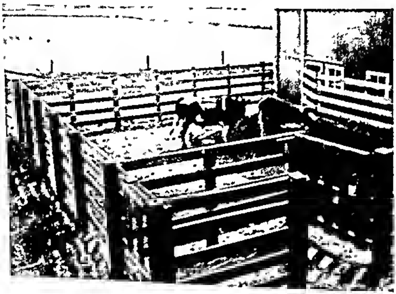


Fig. 36. A Safe Bull Pen. Many farmers have found the electric fence effective in confining bulls. A four-point barbed wire is used directly on the inside of the heavily constructed plank fence. The wire is placed about two-thirds the height of the animal. Insulators and an approved fence controller are used. Special fence brackets are available, permitting the charged wire to be placed 10 to 12 inches inside the plank fence. One should not attempt to attach the wire direct to a 110-volt line, or try to use a homemade fence controller.

How To Build a Safe Bull Pen:—There is no "safe" bull, consequently the wise dairyman will provide a

safe bull pen. Such a pen should afford safety in handling and comfortable quarters. Plans for safe bull pens may be secured from any state agricultural college or from the United States Department of Agriculture.

A safe bull pen provides for feeding and watering to be done by a dairyman without exposing himself

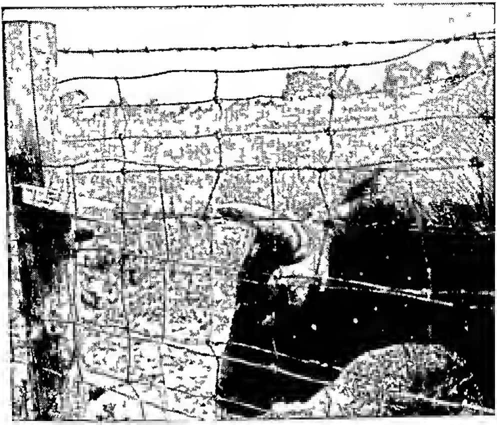


Courtesy U. S. D. A.

Fig. 37. Safe Bull Pen. This is a picture of a safe bull pen. Note the service stall in the foreground.

to attack by the bull. Cows for service may be let in and out through the use of a breeding chute. This is shown by Figures 34, 35, 36, and 37.

It is not necessary to have expensive quarters for a bull, since a certain amount of exposure seems desirable. In the Southern States, a shed left open on the south side should generally prove satisfactory. A bull kept under such conditions will stay in a more rugged condition than if closely housed and will thus stay in good breeding condition.



Courtesy U. S D A.

Fig. 38. Electric Fence. This picture shows bull being confined by use of an electric fence. Note the insulators attached to the post on the inside of the fence.

All fencing should be of strong materials, and should be approximately six feet high. Caution should be taken in building the fence. It should be built strong enough to keep the bull from breaking through. It is very hard to keep a bull in a pen, after he has once broken through.

Rails, planks, barbed wire, iron rails and iron pipes are satisfactory fencing materials. Bulls are usually more content if they can see through or beyond the fence. Heavy posts set 8 feet apart are necessary to carry fencing materials.

Where it is feasible, a lot of an acre or more should be allowed for pasture for the bull. This also assures more exercise. Both pasture and exercise are vital in

keeping a bull active and fertile. Electric fencing is effective in controlling a bull. It is wise to build a good fence then reinforce it with one or two electric wires which will protect the main fence.

Figure 34 shows a model of a safe bull pen. Note the stall, feed alley, lot, breeding chute, and safety gate at breeding stall.

SUGGESTIONS FOR STUDY

A. Questions and Problems

1. Why is the herd sire more than half the herd?
2. Would a bull association be advisable for your community?

B. Activities

1. Write to different breed associations for pedigree, records, and pictures of outstanding individuals.
2. Draw a sketch of a safe bull pen.

C. References

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Chapter VII

CARING FOR COW AND CALF

High producing cows for herd replacement come from healthy well developed calves. The development of good calves begins with good breeding, selection of desirable sire and dam, and proper care and feeding of dam before calf is born.

In studying the management of dairy cows it may appear logical to begin with the fresh cow. The study should, however, begin with the preparation of the cow for freshening. The dry period is a rest period for the cow. It should be used to get an animal in condition so that she will produce a maximum quantity of milk during the lactation (milk producing) period.

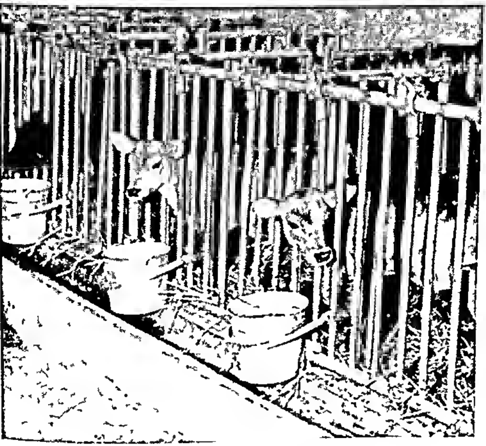
It would be ideal to have the cow calve once every twelve months and allow her six to eight weeks for her rest period. However, many cows will, for various reasons, calve at varying intervals, which will make for some differences in the length of time of the dry period. The cow should replenish her body and build up additional reserves during this time. The main storage of reserve nutrients is in the form of fats and minerals. She may also build up her storage of some of the vitamins. Protein and carbohydrates are not stored to any extent.

Feed consumed by a cow during the dry period probably gives greater returns in extra milk and butterfat than the feed given at any other time.

Drying Off the Cow:—The cow usually takes care of the matter of "drying off" by decreasing in her secretion of milk to a low point where she is no longer milked. There are, however, some persistent milkers that have to be "turned dry."

In any case of "drying off" a cow, the milk stimulating feeds should be decreased or cut out entirely. Low protein grain may be substituted for the high protein dairy feed. Coarse hay may be fed instead of legume hay that is milk stimulating. Succulent feeds can also be reduced. If necessary, the amount of water may be reduced until the cow is dry.

These drastic changes in feed and water are not usually necessary but are advisable in some cases. Along with the changes in feed, the cow may be milked



Courtesy Biltmore Farms

Fig. 40. Healthy Calves. Strict sanitation measures, sufficient ventilation, and proper light are essential for the healthy growth of young dairy animals. The feed and water containers should be clean at all times. Note that these calves have individual pens. They should be kept in individual pens during the milk feeding period. This allows less chance of one calf being infected with a disease of another.

irregularly. One may skip a milking each day for a few days. However, when the cow is milked, she should be milked clean. As the cow begins to "dry off" one may skip a day, then probably two days. The cow should be secreting very little milk when milking is finally ceased.

Another system that is practiced by some dairymen is to stop milking completely and seal the teats with collodion. This method has been in use only in recent years. It is safe if the cow is not producing more than 15 to 20 pounds of milk per day.

The udder should be milked completely clean and examined thoroughly to see that it is in good condition and does not have any infection. The teats should be thoroughly washed, disinfected, and then dipped in collodion (new skin). This serves to seal the teat and thus prevents infection from entering. The udder will "bag" up for a few days. It should be examined to see that there is no infection but should not be milked. The pressure in the udder stops further secretion of milk. The milk is absorbed and the udder returns to its non-functioning form or dry form.

Building Reserves of Fat and Minerals:—After the cow is dry, the feeding should be for the purpose of building up reserves of fat and minerals. The same system should be used for heifers before calving. This does not call for a high protein feed. Usually the same silage and hay that were fed while milking should be continued. This should be supplemented with a grain mixture that is different from that usually fed during the milking period.

The amount of grain or concentrate mixture should vary from three to eight pounds depending on the condition of the cow and the length of time before calving. The mixture should include ground oats, wheat bran, and linseed meal along with other feeds that are

available. These three feeds are "conditioning" feeds and especially important in preparing the cow for freshening.

As the cow or heifer approaches calving, the concentrates should be cut down. A cow should be allowed only one or two pounds at a feeding for two or three days prior to calving. The silage should also be reduced.

Courtesy Ext. Ser. U. S. D. A.

Fig. 41. Teaching Calf to Drink. This calf is being taught to drink by allowing it to suck the fingers when they are placed in a pail of milk. Some dairymen use a special calf nipple pail. This affords an easy means of starting a calf to drink.

Immediately after calving, the cow should be given warm water to drink and be fed a warm wet bran mash. The mash should not be sloppy. This will warm up her system and will tend to start her off in good condition and probably aid in causing her to "clean" or expel the afterbirth. For a few days she should receive the same grain mixture that was fed before calving. After this the milking ration should gradually replace the freshening or dry ration. The amount should be increased slowly as the cow increases her milk production. It may take four weeks or sometimes six weeks to get a cow on maximum feed.

Heavy milkers will reach maximum production during the second month of lactation. During the first few months a heavy milking cow is not able to consume, digest and assimilate sufficient food nutrients to produce all the milk she will secrete. Such a cow takes reserve fats and minerals from her body to maintain the high level of production. Thus she uses up her reserve. As secretion decreases she can take care of her needs. If a cow freshens without much reserve, she will milk down thin very quickly and will never reach her highest possible level of production.

At Calving Time:—There are several signs of approaching calving time or parturition. Most important of these are a fnll udder with teats filled out to the ends, the breaking away or sunken condition on either side of the tail head, and finally the restlessness of the cow. Just before and during calving time a cow should be protected from other cattle and also from other animals. In the summer time the cow may be kept in a lot, but in cool or cold weather or inclement weather she should be placed in a disinfected stall. The stall should be well bedded with straw.

As the cow begins to calve she should not be bothered but should be watched to see if she needs help. As soon as the calf is dropped, the membranes should be removed from its nostrils. The cow will usually take care of cleaning up the calf by licking it. If the calf does not start breathing promptly, artificial respiration should be given This may be done by pumping with the front leg and by working the chest vigorously.

Courtesy U S D A

Fig 42 Drinking Milk. This calf is accepting a drink from Miss Ann Wickard, daughter of a former Secretary of Agriculture

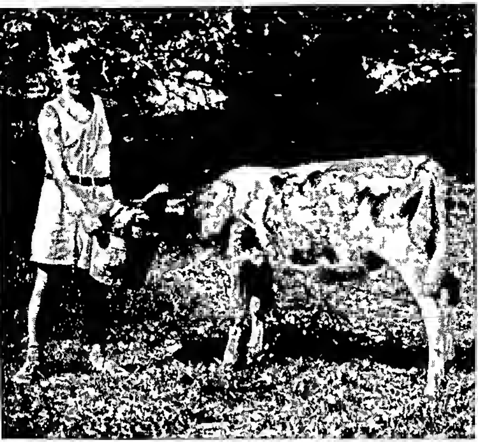
As soon as the calf becomes normal its navel cord may be painted with tincture of iodine or treated with some other disinfectant to prevent infection. Until birth a calf receives its food through the navel cord.

After the calf has been cared for, the udder and teats of the cow should be thoroughly cleaned and examined to see if they are in good condition. A normal calf will find the udder and begin to nurse within a few hours. For a calf to start off well, it is necessary for it to have some of the first milk or colostrum, which varies from normal milk. Colostrum is rich in albumin, minerals, and Vitamin A. It also contains protective antibodies which help to protect the calf against disease infection, and acts as a laxative.

When the cow cleans, the afterbirth should be removed from the stall to prevent her from eating it. If she does eat the afterbirth it may cause digestive trouble or impaction.

It is a general practice to leave the calf with its dam until the third day. This allows the calf to feed often and direct and to get the milk at the body temperature. If they are separated on the third or fourth day, it is usually less difficult to break the attachment they have for each other. Then too, the calf at this age usually learns to drink more readily than if allowed to nurse a longer period.

Teaching the Calf to Drink:—The calf can be taught to drink by allowing it to suck the fingers of a person whose hand is placed in a pan or pail of milk. A rubber nipple in a special calf nipple pail affords an easy means of starting the calf to drink. A nipple also has the advantage of causing the calf to drink slowly. Milk should be fed in clean, sterilized pails. After a few trials, the calf usually learns to drink without assistance.



Courtesy Ext Ser U S D A

FIG 43 The Schooling Is Over. This calf has already learned to drink from a pail

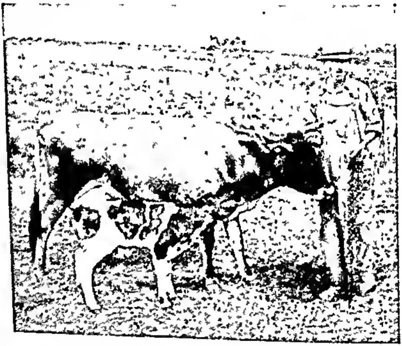
In Farmers' Bulletin Number 1723, it is recommended *that calves be fed whole milk for at least* 3 weeks after they are dropped and that the quantity of milk to be fed twice daily depends on the size and the condition of a calf.

It is further recommended in this bulletin—(1) that the quantity of milk be weighed or measured, (2) that the temperature of the milk when fed be 90° to 100° Fahrenheit, and (3) that milk testing over 4 percent butterfat be diluted with warm water or skim milk.

The addition of one half pint of limewater (made of unslaked or commercial hydrated lime) to the milk at

each feeding appears to aid digestion if the calf is troubled with digestive disturbanees.

While some dairymen prefer to raise calves on whole milk, good calves can be raised on skim milk and milk substitutes. The question of economy should be considered. The plan followed should furnish proper growing nutrients at the lowest cost.



Courtesy U. S. D. A.

Fig. 44. Nurse Cow. Some dairymen use nurse cows. This is especially recommended when a calf is not doing well and for very valuable calves.

Skim milk is one of the most economical of all calf feeds. It is possible to raise well developed calves by feeding it. Changing from whole milk to skim milk should be made gradually when calves are 3 to 4 weeks of age. Crain and hay should be used as supplements. Whole corn and oats are satisfactory for this purpose. A

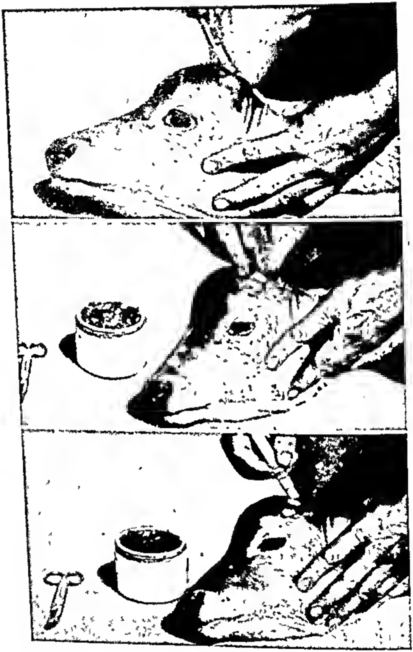
calf learns to eat at an early age. If skim milk is fed directly from a separator—which is an ideal plan—the foam should be removed to prevent bloating. In feeding skim milk the amount may be increased until 12 to 16 pounds are fed daily.

Water should be available for the young calf as soon as it learns to drink.

Calves may be raised on nurse cows. This is especially recommended when a calf is not doing well and for very valuable calves. A high producing cow is able to provide for from 2 to 4 calves.

Courtesy U S D A

Fig. 45. Teaching Calf to Eat. Calves should be taught to eat as soon as possible, especially when milk is not plentiful This calf has not yet learned to like grain feed.



Courtesy Bureau of Dairy Industry U. S. D. A.

Fig. 46. Preventing Horns from Growing. These pictures show the steps in the use of caustic potash to prevent horns from developing. The top picture shows hairs being removed from around horn buttons. The middle picture shows space around the base of the button being greased with vaseline. The bottom picture shows the application of caustic potash.

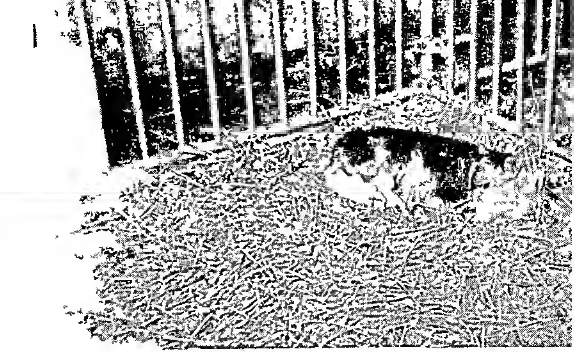


Fig. 46a. Calf Comfort. Dry, clean stalls should be provided to insure calf comfort.

Preventing Horns From Growing:—Horns are desirable only for the sake of appearance or for show cattle. Their development may be prevented by applying caustic potash to the small buttons when the calf is a week to ten days old. The caustic potash may be secured from a local drug store. It should be kept in tightly closed bottles and wrapped with paper before handling.

Before the potash is applied the hair should be clipped from around horn buttons. The space around the base should be greased with vaseline or some grease to prevent burning. The caustic potash stick should be moistened and rubbed on the horn button until the skin begins to slip and slight bleeding occurs. One should be careful not to get any of the caustic in a calf's eyes or any other place, except on the horns. After treatment, a calf should be kept indoors, and under conditions that will prevent his butting his head against other animals or objects.

Dehorning with caustic potash gives a smoother head than when the horns are removed by a clipper or

a saw. Dehorned cows will feed together and be quieter than animals with horns. In the milking herd, there will be less injuries, especially to udders if cows are dehorned.

SUGGESTIONS FOR STUDY

A. Questions and Problems

1. Why should a cow have a rest period before calving?
2. What care and feed should be given a cow prior to calving?
3. What attention should be given to the new born calf? Tell how to teach a calf to drink milk.
4. What are the advantages of dehorning cows? How may it be done?

B. Activities

1. Make up a feeding schedule for a calf to cover from birth to six months old.
2. Outline a procedure for the prevention of horn development.

C. Reference

Feeding, Care and Management of Young Dairy Stock. Farmers' Bulletin No. 1723.

Chapter VIII

JUDGING DAIRY COWS

The selection of dairy cows by type is necessary, since there are records of production on only about three percent of the producing cows in the country. The great majority of cows that are purchased do not have production records, by which the buyer can determine their worth. Where no production information is available, the selection must be made on the basis of what the cow indicates she is capable of producing.

For many generations, breeders of dairy cattle have been breeding and selecting cows for certain characteristics that have been found to be associated with high milk producing ability. While this is not always an accurate means of selecting dairy cows, there is, however, a rather high correlation between the type of cows and their milk and butterfat records when applied to a large number of cows.

A dairyman may expect to be able to select on the basis of type, the good producers from the poor producers—for example, a cow that produces 400 pounds of butterfat from one that produces only 200 pounds. However, he may not be able to differentiate between two cows, one capable of producing 400 pounds of butterfat and the other 500 pounds.

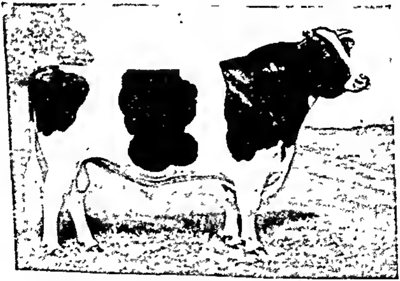
Lynn Copeland of the American Jersey Cattle Club has tabulated the records of 4587 cows that have been classified for type and also have official production records. The results that he obtained and that are recorded in Table 10 show that the Jersey cows that rated high on type had considerably higher records of butterfat than did the cows that rated low on type.

TABLE 10—OFFICIAL PRODUCTION RECORD OF 4,587 COWS RATED ON TYPE

Rating on type	Number of cows	Average production of each group (Mature 365 day equivalent)
Excellent	335	649
Very Good	1,164	614
Good Plus	1,890	590
Good	1,058	553
Fair	139	550
Poor	1	557

In addition to characteristics of type that indicate ability to produce heavily, it is desirable to select cows that indicate that they can stand up under high production over a long period of years. Also, there are certain characteristics that distinguish one breed from another and are considered as extremely important to the breeder.

Other factors that weigh quite heavily with the breeder are straight top lines, level rumps, smooth



Courtesy Holstein-Friesian Association of America

Fig. 47. Ideal Type Bull. This is a drawing of an ideal type Holstein-Friesian bull.

tail settings, typy heads and well balanced udders. However, we find many cows that are good producers that do not conform to all these points. A cow should conform to breed standards as to size, general build, and specific breed characteristics.

Dairy Type:—Dairy type is referred to as the form of a cow that is generally associated with high production. This "dairy form" is readily recognized after long study of good dairy cows. A large barrel indicates that the cow is able to take large quantities of feeds and convert them into milk. A well developed mammary system is associated with a large milk flow.

The angularity of the dairy cow is a contrast to the compact blocky beef animal. This angularity is shown by the wedge shape of the cow of true dairy form, which may be referred to as the triple wedge. The side wedge is shown by the greater depth in the rear barrel and

Courtesy Holstein-Friesian Association of America

Fig. 48. Ideal Type Cow. Here is shown a drawing of an ideal type Holstein-Freisian cow

Courtesy Ext. Ser. U. S. D. A.

Fig. 40. Judging a Ring of Dairy Cows. Through practice in judging dairy cows, pupils learn a part of the procedure to follow in selecting cows. These boys are making a close examination of the cows.

the udder as compared to the depth of the front of the cow. The top wedge is indicated by the angle formed from the hip bones to the withers; and the front wedge by the angularity as shown from the withers to the points of the shoulders.

Dairy Temperament:—The appearance of "milkiness" is the quality which we call dairy temperament. This is, in reality, the outward evidence of the inherited ability of a cow to be an efficient producer of milk. A cow with dairy temperament produces milk even at the expense of her body. Such an animal is lean in form, with ribs wide apart and not heavily covered, and is clean cut over the withers, hips and tail head, instead of being coarse and patchy. A long, slender neck, clean in the brisket, and thin thighs are further evidence of dairy temperament.

A strong stimulation to produce milk results in the cow not carrying surplus flesh even when well fed. However, toward the end of the lactation period, even, the highly developed dairy cow will begin to build a reserve of flesh. Therefore, cows in the latter part of their milking period and while dry should not be criticized for being in a somewhat fleshy condition. On the other hand, a cow lacking in dairy temperament, but in poor condition because of underfeeding, should not be confused with one of good milking qualities.

Body Capacity and Size:—An efficient dairy cow must be able to consume a large amount of feed. A large portion of this feed should be of the roughage type for most economical milk production. A large sized barrel in proportion to the other parts of the cow indicates great capacity. A wide spring of ribs gives width to the body, while broad, flat ribs, spaced well apart gives length. These, along with depth of barrel, give large capacity, but a deep barrel with narrow or

Courtesy Ext. Ser. U. S. D. A.

Fig. 50. A Uniform Group of Jersey Cows. These cows from the Brown Wood, Texas, dairy farm show desirable dairy type. They have well balanced and strongly attached udders.

flat ribs shows lack of capacity. The width of the rump indicates reproductive capacity.

The head is usually indicative of many characteristics of the entire animal. The width of the muzzle shows feeding capacity. An animal that is healthy and vigorous is making good use of its feed. The hide on such an animal is loose and pliable and the hair soft. A cow with a heavy hide and coarse, rough hair shows poor condition and indicates that she is not using her feed most efficiently.

The size of the cow, whether the result of inheritance or of underfeeding during the growing period, has some bearing on producing ability. Cows that are of medium size or large for the breed are on the average heavy producers. The United States Bureau of Dairy Industry tabulated records of cows tested in dairy herd improvement associations and found that within the breed the larger cows excelled in production and profit over feed cost.

Health and Vigor:—The dairy cow is a hard worked animal. She expends an enormous amount of energy in consuming and digesting feed and in converting it into

milk In order to stand up under this, she needs a strong constitution, which is best indicated by strength in the heart girth and by large nostrils and a broad muzzle

The chest should be deep and broad The fore rib that is well sprung gives a wide chest capacity, whereas a flat fore rib pinches the chest and shows a weakness in conformation which is termed "weak in the crops" A cow that is shallow in the chest and flat in

Courtesy U S D A

Fig 51 The Head The head of a dairy cow is usually indicative of many characteristics of the entire animal The width of the muzzle shows feeding capacity The head should be clean cut, dish faced, refined and it should possess a broad muzzle with large open nostrils

the fore rib is not likely to be a high producer, even for one year. There are cows, however, that have inherited a great stimulation for milk secretion, but a weak constitution, that can make a very high record for one lactation period, but are never able to repeat or even again approach that performance.

The replacement of cows in the milking herd is one of the high costs of producing milk. The aim of the breeder is to develop the kind of animals that can last over a long period of years. This is sometimes referred to as cows that wear well. While the average cow leaves the herd at less than eight years of age, many remain profitable until twelve years old or older. Occasionally one may find cows producing and reproducing even at the advanced age of eighteen or twenty years. These long lived cows represent much strength and vigor.

A strong head with large open nostrils, a wide spring of forerib, and a wide and deep heart girth are the main points to observe in considering strength and vigor. However, several other points should be taken into consideration. A ewe neck, weak legs not squarely set under the cow, a weak back, and lack of vigor in general appearance all show the undesirable tendency to weakness.

The Mammary System:—The importance of the mammary system may be evaluated by the percentage of points allowed for it on all score cards. Every breed score card or a general one to apply to all dairy cattle, lists a larger number of points for udder than for any other part of the cow. This is rightly so, since the milk secreting tissues and the supply of milk making nutrients supplied by the blood to the udder is the final determining factor of the output of milk by the cow.

In general, one should look for the size, attachments and balance of the udder and the veining on it, the

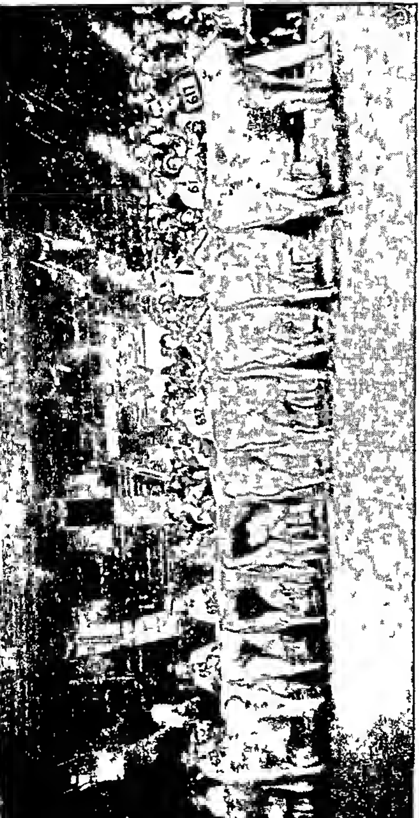


Fig. 52. Outstanding Jersey Cows. This class of aged Jersey cows includes the twelve top cows as placed in the National Dairy Show in 1940 Sir's Standard Bright Beauty 1099701, the Grand Champion of the show, is shown at the head of the class.

size and placement of the teats; and the size, length and tortousness of the milk veins. The desirable udder is one with sufficient capacity to contain secreting tissue abundantly enough to secrete milk in quantity and also to hold the milk secreted from one milking to the next. The size of the udder increases with age until the cow reaches her prime. Until this time is reached, the young cow developes more milk producing tissue with each succeeding lactation.

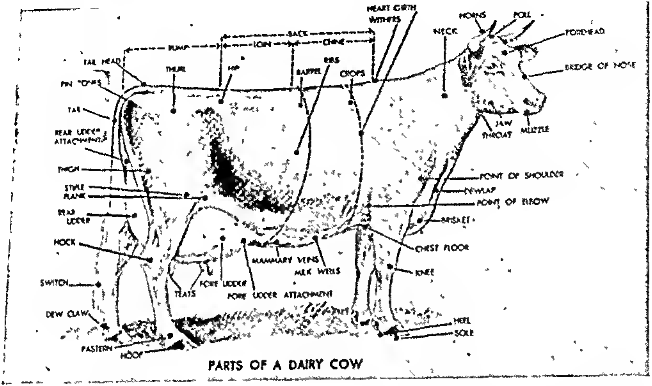
The period of lactation also determines in a large way the size of the udder. The increase in size at calving time and the usually accompanying congestion is due both to storage of milk making material and to poorer circulation throughout the udder. When the swelling has subsided, which usually takes a week to ten days following calving, the udder will resume its normal size and shape. The udder that contains a great deal of meaty tissue, usually contains less milk secreting tissue and thus produces less milk. This type of udder will not milk out and will not become soft and pliable after milking. The udder during the dry period is usually small.

The symmetry and attachments of the udder are of importance for reasons other than beauty. The most desirable form is one that is even in the two halves with the front and rear quarters approaching equal size. Usually the rear quarters are slightly lower than the fore quarters and produce a little more milk. The fore quarters should have a strong attachment well forward on the body. For a desirable rear udder and strong rear attachments, the thighs must be thin and wide apart to allow the udder to extend well back and high up in the rear. A cow with thick thighs will crowd the entire udder forward and cause a lower and weaker rear attachment.

A weak fore attachment is shown by the quarters not being held up snugly and gives the appearance of pulling away. Cases that are not evident at a distance may be found by placing the hand between the udder and stomach wall. Strong attachments are important since a broken away udder will become pendulous. This will cause more difficulty in handling an udder after freshening. The congestion or cake in a pendulous udder is not readily absorbed and thus results in a longer period elapsing before the udder returns to a normal condition. Pendulous udders receive more injuries than snugly supported ones. They are more subject to cuts, bruises, stepping on teats, exposure when lying on cold damp ground, and many other injuries. They also are less resistant to mastitis infections. Pendulous udders or weak attachments are more heavily discriminated against in young cows, first and second calf heifers, than in older cows. This weakness increases with age and lactations.

The size of the teats and even placement on the udder is important because of ease and convenience of milking. Teats placed too close together or extremely wide apart are usually hard to milk and give the udder an unbalanced and unsightly appearance. Short teats are hard to milk because of the necessity of stripping them between the thumb and fingers rather than full hand milking. Various odd shaped and extremely large teats may also present milking difficulties.

The veining on the dairy cow bears quite a close correlation to producing capacity. The veining on the udder indicates good circulation within the udder. The abdominal or mammary veins carry the blood away from the udder to the heart. Their size appears to be developed to take care of the job to be done. thus large, long and tortuous ones are capable of transferring large quantities of blood away from the udder



Courtesy The Purebred Dairy Cattle Association

Fig. 53. Parts of a Dairy Cow. It is important for a student of dairy cattle to know the parts of an animal referred to in the score card. These various parts of a dairy cow are indicated in the illustration above.

after it has supplied the secreting tissue with milk forming nutrients Some cows have only two small, straight veins, each going through the abdominal wall at just one small milk well. On others you will find both veins branching one or several times and having up to eight or ten or even twelve milk wells. The milk veins and wells vary in size with the age of the cow and with her period of lactation.

Guide To Evaluation of Defects in Judging Cows

NOTE *In a show ring, disqualification means that the animal is not eligible to win a prize Any disqualified animal is not eligible to be shown in the group classes In slight to serious discrimination, the degree of seriousness shall be determined by the judge*

Eyes
1. Total blindness *Disqualification*
2. Blindness in one eye *Slight discrimination*

Parrot Jaw
Slight to serious discrimination

Shoulders
Winged. *Slight to serious discrimination*

Capped Hip
Slight discrimination

Wry Tail
Serious discrimination

Legs and Feet
1. Marked lameness—apparently permanent and interfering with normal function *Disqualification*
2. Lameness—apparently temporary and not affecting normal function—bucked knees, crooked hindlegs, weak pasterns: *Slight to serious discrimination*
3. Enlarged knees: *Slight discrimination.*

Absence of Horns
An animal that has been cleanly and neatly dehorned, and whose head shows true breed character *No discrimination*

Lack of Size
Slight to serious discrimination

Udder
1. One or more blind quarters *Disqualification*
2. Abnormal milk (bloody, clotted, watery) *Possibly disqualification. A slight to serious defect.*
3. Udder definitely broken away in attachment: *Serious discrimination.*
4. A weak udder attachment: *Slight to serious discrimination.*

5. One or more light quarters, hard spots in udder, side leak or obstruction in teat (spider): *Slight to serious discrimination.*

Dry Cows
In case of cows of apparently equal merit: *Give preference to cows in milk.*

Overconditioned
Serious discrimination.

Temporary or Minor Defects
Blemishes or injuries of a temporary character not affecting animal's usefulness: *Slight to no discrimination.*

Evidence of Sharp Practice
1. Animals showing signs of having been operated upon or tampered with for the purpose of concealing faults in conformation, or with intent to deceive relative to the animal's soundness: *Disqualification.*
2. Heifer calves showing evidence of having been milked, in an attempt to deceive regarding natural form of udder: *Serious discrimination.*

Approved—The Purebred Dairy Cattle Association, 1942.

AYRSHIRE CHARACTERISTICS

Color—Red of any shade, mahogany, brown, or these with white, or white, each color clearly defined. Distinctive red and white markings preferable; black or brindle markings strongly objectionable.

Size—A mature cow in milk should weigh about 1150 lbs.

Horns—Inclining upward, small at base, refined, medium length and tapering toward tips.

BROWN SWISS CHARACTERISTICS

Strong and vigorous. Extreme refinement not desired. Size and ruggedness with quality desired.

Color—A shade of brown varying from a silver to a dark brown. Hair inside ears is a lighter color than body. Nose and tongue black, with a light colored band around nose. Color markings which bar registry are: white switch, white on sides, top, head or neck and legs above knees or hocks. White on belly or lower legs objectionable.

Size—A mature cow in milk should weigh about 1400 lbs.

Horns—Inclining forward and slightly up. Moderately small at base, medium length, tapering toward black tips.

GUERNSEY CHARACTERISTICS

Color—A shade of fawn with white markings clearly defined, black or brindle markings objectionable. Skin should show golden yellow pigmentation. When other points are equal, a clear or buff muzzle will be favored over a smoky or black muzzle.

Size—A mature cow in milk should weigh about 1100 lbs.

Horns—Inclining forward, small and yellow at base, refined, medium in length and tapering toward tips.

HOLSTEIN CHARACTERISTICS

Color—Black and white markings clearly defined. Color markings which bar registry are solid black, solid white, black in switch, black belly, black encircling leg touching hoof, black from hoof to knee or hock, black and white intermixed to give color other than distinct black and white.

Size—A mature cow in milk should weight about 1500 lbs.

Horns—Inclining forward, incurving, small at base, refined, medium length and tapering toward tips.

JERSEY CHARACTERISTICS

Color—A shade of brown, fawn or black, with or without white markings.

Size—A mature cow in milk should weigh about 1000 lbs.

Horns—Inclining forward, incurving, small at base, refined, me dium length and tapering toward tips.

The Score Card:—The student of dairy cattle type can obtain much information by the study and use of score cards. They are guides by which a systematic study of the animal can be made. It is necessary to become familiar with the nomenclature of the various parts of the cow in order to use the score card effectively or to follow judges in their discussion of animals and reasons for certain placings. The different parts of the cow are illustrated in Figure 53.

The Dairy Cow Score Card on page 124 is the one approved in 1942 by The Purebred Dairy Cattle Association—a combined organization of the five major dairy breed associations, organized for the advancement of purebred dairy cattle. There are four main divisions of this score card, namely: (1) general appearance, (2) dairy character, (3) body capacity, and (4) mammary system. The relative weight allowed for each division is indicated by the numerical figures. Under each division is listed the subdivisions with a brief description. The naming and description of the various parts should be studied along with the weight given each one, until the student is familiar with the

Dairy Cow Score Card

Ideals of type and breed characteristics must be considered in the application of the terminology of this score card

Based on Order of Observation		Perfect Score	Cow A	Official Score	Cow B	Official Score
1. GENERAL APPEARANCE		30				
Attractive individuality, revealing vigor, femininity with a harmonious blending and correlation of parts. Impressive style and attractive carriage with a graceful walk.						
BREED CHARACTERISTICS (See below)	12					
HEAD—medium in length, clean-cut; broad muzzle with large open nostrils, lean, strong jaw, full, bright eyes; forehead broad between the eyes and moderately dished, bridge of nose straight; ears medium size and alertly carried.	—					
SHOULDER BLADES set smoothly against chest wall and withers, forming neat junction with the body.						
BACK strong and appearing straight with vertebrae well defined.						
LOIN broad, strong and nearly level.						
RUMP long, wide; top-line level from loin to and including tail head.	10					
HIPS wide, approximately level laterally with back, free from excess tissue.						
THURLS wide apart.						
PIN BONES wide apart and slightly lower than hips, well defined.						
TAIL HEAD slightly above and neatly set between pin bones.						
TAIL long and tapering with nicely balanced switch.	—					
Legs wide apart, squarely set, clean-cut and strong with fore legs straight.						
HIND LEGS nearly perpendicular from hock to pastern When viewed from behind, legs wide apart and nearly straight. Bone, flat and flinty, tendons well defined. Pasterns, of medium length, strong and springy. Hocks cleanly moulded.	8					
FEET short and well rounded, with deep heel and level sole.	—					
2. DAIRY CHARACTER		20				
Animation, angularity, general openness, and freedom from excess tissue, giving due regard to period of lactation.						
NECK long and lean, blending smoothly into shoulders and brisket; clean-cut throat and dewlap.						
WITHERS well defined and wedge-shaped with the dorsal processes of the vertebrae rising slightly above the shoulder blades.	20					
RIBS wide apart. Rib bone wide, flat and long.						
FLANK deep, arched and refined.						
THIGHS incurving to flat from the side; wide apart when viewed from the rear, providing sufficient room for the udder and its attachment.						
SKIN of medium thickness, loose, and pliable. Hair fine.	—					
3. BODY CAPACITY		20				
Relatively large in proportion to size of animal, providing ample digestive capacity, strength and vigor.	12					
BARREL deep, strongly supported, ribs wide apart and well sprung; depth and width tending to increase toward rear of barrel.	—					
HEART GIRTH large, resulting from long, well sprung forerib, wide chest floor between front legs, and fullness at the point of elbow.	8					
4. MAMMARY SYSTEM		30				
A capacious, strongly attached, well carried udder of good quality, indicating heavy production and a long period of usefulness						
UDDER—CAPACITY and SHAPE long, wide and of moderate depth. Extending well forward, strongly attached, reasonably level floor. Rear attachment, high and wide. Quarters evenly balanced and symmetrical.	25					
TEXTURE soft, pliable and elastic. Well collapsed after milking.						
TEATS uniform, of convenient length and size, cylindrical in shape, free from obstructions, well apart and squarely placed, plumb.	—					
MAMMARY VEINS long, tortuous, prominent and branching, with numerous large wells. Veins on udder numerous and clearly defined.	5					
TOTAL		100				

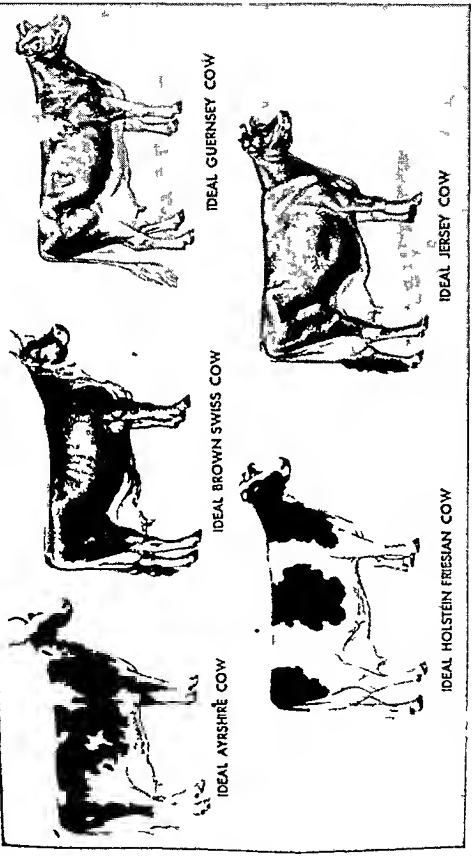


Fig 51 Ideal Cows The illustrations on this page show drawings of ideal cows for the five leading dairy breeds of America

location of every part, its relation to the fonction of the cow and its relative importance in evaluating the animal or in comparing a number of animals.

This card replaces the individual breed score card. To allow for differences in breeds, certain characteristics of each breed are enumerated on pages 122 and 123. Type and breed character must be considered in the use of the card. This score card considers certain characteristics common to all breeds of dairy cattle, but does not attempt to bring together the various breed differences.

Look for Defects:—There are some defects that should be looked for when selecting cows. The most serious of these is unsoundness of the udder. This may be in the form of a weak quarter, or even a completely blind quarter, or hard spots in the udder, or an obstruction (spider) in the teat, or a side leak. These defects may be of temporary nature or permanent. A cow may get a knocked down hip which may vary in its extent from hardly noticeable to causing permanent lameness. Enlarged knees and bocked knees should be discriminated against according to the extent of their effect on the utility of the cow. Inherited defects are to be dealt with more seriously. These may be in the form of twisted muzzles, wry tail settings, or udders with only three quarters. In the case of bulls, the defect may be that the animal has only one testicle.

A pupil should study carefully the Guide to Evaluation of Defects in Judging Cows given on page 121.

Value of Score Card to Pupil:—The importance of knowledge of dairy type has its greatest value in the actual selection of cows for production and for breeding purposes. This may be applied to selection from several herds or entirely from one herd. Group study lends itself more easily to the evaluation of individuals and to comparative study of several individuals.

In comparative judging, four to six animals are usually used for class work, however in the show ring the entries may run to forty or fifty and occasionally far in excess of this number. In ranking animals in either of the above cases, they are compared on the basis of their entirety, and they are placed according to the evaluation made by the judge of the relative trueness to the desired type.

The score card is not used by judges in the show ring, but it has helped to fix in the judge's mind the ideal type animal and also the valuations to be placed on the several points that he considers in making his placings. In student judging classes the score cards are used to acquaint the student with the parts of the animal and their relative value. It is seldom employed in comparative placing. The knowledge of it will cause the student to carefully examine each animal more thoroughly and to weigh points more accurately. The training which this type of study gives the student is far more valuable than many other types of class work. Close observation of details and his reasoning as to why he will place one animal over another trains the student to carefully consider what he has seen. It requires him to make decisions based on facts and then back up his placings with justifiable reasons.

Procedure in Judging:—The most common procedure in comparative placing, whether in class exercises or in judging contests, is to lead the animals around in a circle with the students or contestants in the center. This will take from three to five minutes. The circle should be sufficiently large to have the cows twelve to fifteen feet from the students. The cows should be numbered 1, 2, 3, 4, etc., or A, B, C, D, etc. with the one in front being 1 or A and the others following in order. While the cows are moving, they are studied for gen-

Fig. 55. Class of Cows. These cows were fitted and are being shown by students. Competition is on the basis of how well each pupil has fitted and trained his animal for the show ring and the skill with which the animal is shown.

eral appearance, style, breed type, balance of form, straightness of top line, levelness of rump, strength of legs, and how well each moves. The relative size and capacity can best be determined while the cows are moving. The size of udder and whether it is pendulous and interferes with the animal's walk can be observed as well as lameness or other defects.

The cows should then be lined up head to tail, a few feet apart, for two or three minutes to be observed at a distance. This allows the student to study more closely some of the points not clearly observed while in motion. The angularity, the depth of barrel, the depth of chest, the straightness and strength of top line while standing, the straightness of legs and how squarely they are set under the cow can be determined. Whether the cow crowds her udder forward, or if it is breaking away in front, and other points of question can be cleared up.

The next step should be to line the cows up, side by side about six feet apart for five minutes, to give opportunity for comparison in this position and for close observation to make a final checkup on points still in question. From the front, one can observe the refinement and quality of the head, the strength of muzzle, the angularity of the withers, the cleanness of the brisket, the width of the chest floor, and the spring of ribs. An observation from the rear will give the width of the rump, the width of the barrel, the thinness of the thighs and the width between them, and the height and strength of the rear udder attachment. The handling of the cows gives opportunity to find out the quality of the udder, the snugness of the fore attachment, the amount of veining, the number and size of the milk wells, and the pliability and softness of the hide and hair. Also a final checkup should be made for possible defects.

After the student has studied a class of cows as outlined, he should carefully weigh all the points observed in each cow, both the strong or desirable qualities and the weak or undesirable qualities of each animal. The cows should then be placed in the order of their excellence.

To be able to substantiate the placing with logical reasons is the final step in class work or in contests. With judges in the show ring, it is a great asset to be able to give complete and understandable reasons that will justify the placing. The reasons should emphasize the most important differences in the animals, with minor differences receiving less consideration. Above all the reasons should be accurate and as nearly complete as possible. For teaching purposes, written or oral reasons or both are valuable. Oral reasons should be used most of the time, however, written reasons may supplement them.

A good set of reasons can be given only when (1) the correct observations have been made, (2) a knowledge of the various points has been obtained, (3) a speaking knowledge of terms used in effectively comparing animals has been acquired, and (4) a well organized system of following through has been developed.

Rules for Giving Reasons:—The following rules for giving reasons may be effectively followed:

1. State the class and your placing, as: I placed this class of Guernsey Cows, DCAB.
2. Give the reasons for your placing by comparing pairs. In four animal classes there are three pairs to discuss. Make practically all statements comparative rather than descriptive.
3. When the top animal is outstanding in the class, state it before going ahead with comparisons.

4. When the animal that is placed down in the pair is superior in one or more points to the one placed over her, recognize these points before giving reasons for placing the top animal of the pair over the bottom animal.
5. After comparisons of the pair are finished, recognize weaknesses or faults in the bottom animal that may have influenced you a great deal in making your decision for your placing.
6. Do not use the words. good, better, or best. Make a statement telling just why the one animal is superior to the other.
7. Present comparisons in a logical order so that no vital point will be left out.
8. Develop a vocabulary of comparative and descriptive terms. Use words that are recognized as cattle terms.
9. When the reasons have been completed, a final statement of your placings should be made.

Descriptive Terms:—The following are some descriptive terms applicable to dairy cattle:

1. *Head:*—clean cut, dish faced, refined, feminine, full bright eyes, broad muzzle, large open nostrils, strong jaw.
   Criticisms—coarse, staggy, weak, narrow, plain.
2. *Neck:*—long and clean, smooth at junction with shoulder, smooth in brisket.
   Criticisms—short, thick, coarse, throaty, heavy dewlap. U-necked.
3. *Shoulders:*—clean and smooth over withers, smooth in shoulders, free from patchiness.
   Criticisms—coarse and heavy over withers, open shoulders, beefy in the shoulders, winged shoulders.

4. *Back:*—straight in topline, strong, loin level and wide, vertebra free from fleshiness.
   Criticisms—low in back, weak loin, narrow loin, sway backed.
5. *Body:*—deep in middle, wide spring of rib, wedge shape, open ribbed, full in the crops, deep in flank, well sprung forerib, deep in the chest, full in the chest.
   Criticisms—shallow in the body, flat ribbed, slab ribbed, short bodied, shallow in flank, narrow bodied, pinched in the heart, weak in crops, leggy.
6. *Rump:*—level from hips to pin bones, long from hips to pin bones, wide through the rump, high in the thurls, smooth tail setting, clean over hipbones.
   Criticisms—sloping, pinched in the pins, short, patchy over tail head, low at the thurls, high tail head, narrow across hips.
7. *Legs:*—straight, squarely placed under body, fine strong bone, thin in thigh, thighs wide apart.
   Criticisms—weak, sickle hocked, stands with hind feet far under body, front legs close together, thick in thighs.
8. *Mammary Development:*—
   Udder:—evenly balanced, capacious, extends well up behind, attached high and strong, extends well forward and strongly attached, quarters even, soft and pliable texture, level on floor, veining on udder prominent, free from lumps.

   Teats: evenly placed, uniform size and of convenient size.

   Milk veins and wells: large, long, crooked, branching, extending far up on body, numerous wells, large wells.

Criticisms—

Udder—small, lacks capacity, cleft between halves, cut up between quarters, unbalanced, weak quarter, blind quarter, breaking away from body, pendulous, pushed forward, pinched between the thighs, meaty, lumps in udder.

Teats—small, short, too long, placed too close together, unevenly placed, not of uniform size, extra teats, leaky teats, side leaks.

Milk veins and wells—small, short, not prominent, straight wells, small.

9. *General Appearance:*—stylish, milky looking, shows breed type, thrifty and vigorous, bloom, fine hide and hair, good size for the breed, smooth, refined, alert.

Criticism—sluggish, coarse throughout, coarse hair and thick hide, poor condition or finish, small for the breed, lack of refinement, lack of dairy temperament, off type, leggy, lack of dairy conformation.

Special Placing Card:—In many judging contests, where there are large numbers of contestants which makes the use of either oral or written reasons unwieldy, a type of placing card is often used which takes the place of reasons. One such is reproduced below. This one is used by the Future Farmers of America in their national dairy judging contest as well as in most of their state contests. In the use of this card the contestant places the class on each of the four points, (1) general appearance, (2) body capacity, (3) dairy character, and (4) mammary system. He then makes a final placing which should be in keeping with that on the individual points. In grading these cards, the four subdivisions combined carry the same weight as the final placing. This is sometimes called a reason card.

Special Dairy Cattle Placing Card Instructions

—General Appearance:—From a distance of ten or fifteen feet, observe the animals to be judged. Look for dairy type, proportion of the various parts, smoothness, especially in the neck, withers, shoulders, hips and tail head. Also, style of ani-

Class____________

PLACING CARD FOR DAIRY CATTLE

Name of Contestant___________________ Name of School_________________

Placing on Comparative Points	1st	2nd	3rd	4th	Grade
General Appearance					
Body Capacity					
Dairy Character					
Mammary System					
Final Placing Order					

Contestant's Final Grade_________

mal, refined head and neck, strength and straightness of topline, levelness of rump, straightness of legs, general condition, size and trueness to individual breed characteristics.

—Body Capacity:—Study the animal to observe the strength of muzzle, depth of heart girth and spring of fore rib. Look for feeding capacity indicated by length of barrel, spring of body ribs and depth of body; in addition, observe width at hips, loin, rump and pin bones.

—Dairy Character:—The points to look for in dairy character are those associated with milkiness;

dairy quality as compared to tending toward beefiness. Look for general angularity, cleancut head, alertness, long clean neck, smooth over shoulders and sharp at withers, free from patchiness at hips and tail head (heavy springing heifers and cows may show somewhat heavier, especially over withers). Observe the thinness and quality of the skin and the fineness of the hair. Do not mistake under-condition or weakness for dairy temperament.

—Mammary System:—Observe the udder for size, shape, balance, quality and soundness. Notice especially the strength of attachments; is the fore udder breaking away from the stomach wall, is the rear udder broad and attached high; are the thighs thin and wide apart to allow space for udder without pushing it forward. A pendulous udder is undesirable. Look for the size and placement of teats. Observe the veining on the udder and on the belly, large crooked veins extending well up toward the chest are indicative of producing ability. Also notice the number and size of the milk wells.

Note:—It must be remembered that the animals are placed according to the animal as a whole. The difference between two animals in one of these points may be far greater than in another. This must be considered in making the final placing.

The application of this card and the weighing of the different points will vary when applied to immature females and to bulls.

Grading Placings:—In contests and usually in class work, the placings are graded on the basis of the official ranking of the animals. These placings may be graded by a standard grading card with even cuts for

all switches. To render the grading more accurate, each class may be considered separately and the amount of cuts to be determined by the closeness of the pair or by the great amount of difference between them. The standard for grading placings listed on pages 136 and 137 is the one that is commonly used.

Judging Heifers:—The same general principles for judging dairy cows are used for judging dairy heifers.

STANDARD FOR GRADING PLACINGS

ABCD	100	ABDC	100	ACBD	100	ACDB	100	ADBC	100	ADCB	100
ABDC	85	ABCD	85	ACDB	85	ACBD	85	ADCB	85	ADBC	85
ACBD	85	ADBC	85	ABCD	85	ADCB	85	ABDC	85	ACDB	85
ACDB	70	ADCB	70	ABDC	70	ADBC	70	ABCD	70	ACBD	70
ADBC	70	ACBD	70	ADCB	70	ABCD	70	ACDB	70	ABDC	70
ADCB	55	ACDB	55	ADBC	55	ABDC	55	ACBD	55	ABCD	55
BACD	85	BADC	85	CABD	85	CADB	85	DABC	85	DACB	85
BADC	70	BACD	70	CADB	70	CABD	70	DACB	70	DABC	70
BCAD	70	BDAC	70	CBAD	70	CDAB	70	DBAC	70	DCAB	70
BCDA	55	BDCA	55	CBDA	55	CDBA	55	DBCA	55	DCBA	55
BDAC	55	BCAD	55	CDAB	55	CBAD	55	DCAB	55	DBAC	55
BDCA	40	BCDA	40	CDBA	40	CBDA	40	DCBA	40	DBCA	40
CABD	70	DABC	70	BACD	70	DACB	70	BADC	70	CADB	70
CADB	55	DACB	55	BADC	55	DABC	55	BACD	55	CABD	55
CBAD	55	DBAC	55	BCAD	55	DCAB	55	BDAC	55	CDAB	55
CBDA	40	DBCA	40	BCDA	40	DCBA	40	BDCA	40	CDBA	40
CDAB	40	DCAB	40	BDAC	40	DBAC	40	BCAD	40	CBAD	40
CDBA	25	DCBA	25	BDCA	25	DBCA	25	BCDA	25	CBDA	25
DABC	55	CABD	55	DACB	55	BACD	55	CADB	55	BADC	55
DACB	40	CADB	40	DABC	40	BADC	40	CABD	40	BACD	40
DBAC	40	CBAD	40	DCAB	40	BCAD	40	CDAB	40	BDAC	40
DBCA	25	CBDA	25	DCBA	25	BCDA	25	CDBA	25	BDCA	25
DCAB	25	CDAB	25	DBAC	25	BDAC	25	CBAD	25	BCAD	25
DCBA	10	CDBA	10	DBCA	10	BDCA	10	CBDA	10	BCDA	10

BACD	100	BADC	100	BCAD	100	BCDA	100	BDAC	100	BDCA	100
BADC	85	BACD	85	BCDA	85	BCAD	85	BDCA	85	BDAC	85
BCAD	85	BDAC	85	BACD	85	BDCA	85	BADC	85	BCDA	85
BCDA	70	BDCA	70	BADC	70	BDAC	70	BACD	70	BCAD	70
BDAC	70	BCAD	70	BDCA	70	BACD	70	BCDA	70	BADC	70
BDCA	55	BCDA	55	BDAC	55	BADC	55	BCAD	55	BACD	55
ABCD	85	ABDC	85	CBAD	85	CBDA	85	DBAC	85	DBCA	85
ABDC	70	ABCD	70	CBDA	70	CBAD	70	DBCA	70	DBAC	70
ACBD	70	ADBC	70	CABD	70	CDBA	70	DABC	70	DCBA	70
ACDB	55	ADCB	55	CADB	55	CDAB	55	DACB	55	DCAB	55
ADBC	55	ACBD	55	CDBA	55	CABD	55	DCBA	55	DABC	55
ADCB	40	ACDB	40	CDAB	40	CADB	40	DCAB	40	DACB	40
CBAD	70	DBAC	70	ABCD	70	DBCA	70	ABDC	70	CBDA	70
CBDA	55	DBCA	55	ABDC	55	DBAC	55	ABCD	55	CBAD	55
CABD	55	DABC	55	ACBD	55	DCBA	55	ADBC	55	CDBA	55
CADB	40	DACB	40	ACDB	40	DCAB	40	ADCB	40	CDAB	40
CDBA	40	DCBA	40	ADBC	40	DABC	40	ACBD	40	CABD	40
CDAB	25	DCAB	25	ADCB	25	DACB	25	ACDB	25	CADB	25
DBAC	55	CBAD	55	DBCA	55	ABCD	55	CBDA	55	ABDC	55
DBCA	40	CBDA	40	DBAC	40	ABDC	40	CBAD	40	ABCD	40
DABC	40	CABD	40	DCBA	40	ACBD	40	CDBA	40	ADBC	40
DACB	25	CADB	25	DCAB	25	ACDB	25	CDAB	25	ADCB	25
DCBA	25	CDBA	25	DABC	25	ADBC	25	CABD	25	ACBD	25
DCAB	10	CDAB	10	DACB	10	ADCB	10	CADB	10	ACDB	10

STANDARD FOR GRADING PLACINGS

CABD	100	CADB	100	CBAD	100	CBDA	100	CDAB	100	CDBA	100
CADB	85	CABD	85	CBDA	85	CBAD	85	CDBA	85	CDAB	85
CBAD	85	CDAB	85	CABD	85	CDBA	85	CADB	85	CBDA	85
CBDA	70	CDBA	70	CADB	70	CDAB	70	CABD	70	CBAD	70
CDAB	70	CBAD	70	CDBA	70	CABD	70	CBDA	70	CADB	70
CDBA	55	CBDA	55	CDAB	55	CADB	55	CBAD	55	CABD	55
ACBD	85	ACDB	85	BCDA	85	BCDA	85	DCAB	85	DCBA	85
ACDB	70	ACBD	70	BCAD	70	BCAD	70	DCBA	70	DCAB	70
ABCD	70	ADCB	70	BACD	70	BDCA	70	DACB	70	DBCA	70
ABDC	55	ADBC	55	BADC	55	BDAC	55	DABC	55	DBAC	55
ADCB	55	ABCD	55	BDCA	55	BACD	55	DBCA	55	DACB	55
ADBC	40	ABDC	40	BDAC	40	BADC	40	DBAC	40	DABC	40
BCAD	70	DCAB	70	ACBD	70	DCBA	70	ACDB	70	BCDA	70
BCDA	55	DCBA	55	ACDB	55	DCAB	55	ACBD	55	BCAD	55
BACD	55	DACB	55	ABCD	55	DBCA	55	ADCB	55	BDCA	55
BADC	40	DABC	40	ABDC	40	DBAC	40	ADBC	40	BDAC	40
BDCA	40	DBCA	40	ADCB	40	DACB	40	ABCD	40	BACD	40
BDAC	25	DBAC	25	ADBC	25	DABC	25	ABDC	25	BADC	25
DCAB	55	BCAD	55	DCBA	55	ACBD	55	BCDA	55	ACDB	55
DCBA	40	BCDA	40	DCAB	40	ACDB	40	BCAD	40	ACBD	40
DACB	40	BACD	40	DBCA	40	ABCD	40	BDCA	40	ADCB	40
DABC	25	BADC	25	DBAC	25	ABDC	25	BDAC	25	ADBC	25
DBCA	25	BDCA	25	DACB	25	ADCB	25	BACD	25	ABCD	25
DBAC	10	BDAC	10	DABC	10	ADBC	10	BADC	10	ABDC	10

DABC	100	DACB	100	DBAC	100	DBCA	100	DCAB	100	DCBA	100
DACB	85	DABC	85	DBCA	85	DBAC	85	DCBA	85	DCAB	85
DBAC	85	DCAB	85	DABC	85	DCBA	85	DACB	85	DBCA	85
DBCA	70	DCBA	70	DACB	70	DCAB	70	DABC	70	DBAC	70
DCAB	70	DBAC	70	DCBA	70	DABC	70	DBCA	70	DACB	70
DCBA	55	DBCA	55	DCAB	55	DACB	55	DBAC	55	DABC	55
ADBC	85	ADCB	85	BDAC	85	BDCA	85	CDAB	85	CDBA	85
ADCB	70	ADBC	70	BDCA	70	BDAC	70	CDBA	70	CDAB	70
ABDC	70	ACDB	70	BADC	70	BCDA	70	CADB	70	CBDA	70
ABCD	55	ACBD	55	BACD	55	BCAD	55	CABD	55	CBAD	55
ACDB	55	ABDC	55	BCDA	55	BADC	55	CBDA	55	CADB	55
ACBD	40	ABCD	40	BCAD	40	BACD	40	CBAD	40	CABD	40
BDAC	70	CDAB	70	ADBC	70	CDBA	70	ADCB	70	BDCA	70
BDCA	55	CDBA	55	ADCB	55	CDAB	55	ADBC	55	BDAC	55
BADC	55	CADB	55	ABDC	55	CBDA	55	ACDB	55	BCDA	55
BACD	40	CABD	40	ABCD	40	CBAD	40	ACBD	40	BCAD	40
BCDA	40	CBDA	40	ACDB	40	CADB	40	ABDC	40	BADC	40
BCAD	25	CBAD	25	ACBD	25	CABD	25	ABCD	25	BACD	25
CDAB	55	BDAC	55	CDBA	55	ADBC	55	BDCA	55	ADCB	55
CDBA	40	BDCA	40	CDAB	40	ADCB	40	BDAC	40	ADBC	40
CADB	40	BADC	40	CBDA	40	ABDC	40	BCDA	40	ACDB	40
CABD	25	BACD	25	CBAD	25	ABCD	25	BCAD	25	ACBD	25
CBDA	25	BCDA	25	CADB	25	ACDB	25	BADC	25	ABDC	25
CBAD	10	BCAD	10	CABD	10	ACBD	10	BACD	10	ABCD	10

From U. S. D. A. Farms Bul. 1769.

However, they cannot be applied as accurately as it is not possible to tell just how a heifer will develop. Heifers change in body conformation as they develop, so a more general consideration of the characteristics of the heifer is made than in the case of the cow.

General appearance, style, and breed type weigh quite heavily. Heifers should show strength and

straightness, be level in the rump, have strong heads and be rugged, but not coarse.

Body conformation is quite indicative in the heifer, even though she does not have feeding capacity in proportion to her size as does the mature cow. The heifer does not show angularity to the extent of producing cows. This is many times due to carrying more covering of flesh. They should show quality, be clean cut, and well grown for their age. Not so much emphasis can be placed on mammary development, however, the udder should be well developed for her age, with even development in each quarter. The teats should be uniform in size and evenly placed. The routine used in judging cows can be followed in judging heifers.

Requirements to Become Good Judge:—Long experience and thorough study are necessary to become a good judge of dairy cattle. To be capable of selecting producing cows and to select the cow within the herd from which to build the future herd, behooves the breeder, the dairyman, and the student to continually study the type of desirable dairy cattle. This can be done by working untiringly with good cattle, supplemented by the study of animals in show rings, and by becoming a student of the information presented in the dairy breed papers.

SUGGESTIONS FOR STUDY

A. Questions and Problems

1. Learn the names of the parts of a dairy cow.
2. Learn by memory the main divisions and the subdivisions of the general dairy cow score card, and the evaluation of these points.

B. Activities

1. Place classes of four or more animals each.
2. Prepare written reasons on the classes.
3. Give oral reasons on the classes.
4. Prepare classes for judging by selecting pictures from breed papers to be judged.

C. References

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2. Nystrom, A. B., Dairy Cattle Breeds, U. S. D. A., Farmers Bulletin 1443.
3. Nevens, W. B. and Kuhlman, A. F., Selecting Dairy Cattle, Illinois Agricultural Experiment Station, Circular 486.
4. Judging material from each of the breed associations.
5. Livestock Judging Handbook—Nordby, Beeson, Fourt—1940. Interstate, Danville, Ill.

CHAPTER IX

SELECTING THE DAIRY BREED

There are five recognized major dairy breeds in the United States. The choice of a breed is usually based on association with it. The new breeder is many times infinenced by the breed kept by his neighbors. When there are two or more breeds in a community or when the prospective breeder has had some contact with more than one breed, the selection may be made purely on personal preference.

The type of market for milk or milk products may play a part in the selection. The availability of foundation animals for starting the herd is another factor that affects the choice.

After all, the matter of breed selection is not as important as getting the rigbt kind of fonndation animals with which to begin. The major dairy breeds vary little in real efficiency. There is a great deal more difference between cows of the same breed than there is between breeds.

A dairyman who is a failure with one breed cannot be expected to do well with another. On the other hand, we have many examples of efficient herd managers who have made a success with more than one breed.

It is important, however, that a breed be chosen and developed entirely witbin tbe breed. Crossing of breeds will tear down the characteristics that have taken many generations to get fixed within the breed. While not all purebred animals are profitable, a mnch larger percentage of them are desirable than are grade animals. Breeders have mated selected animals and built their herds and the breed toward higber efficiency

for many years. The breeder of today can start with a well established breed and take advantage of what breeders have already accomplished.

Breed Predominating in Locality:—The prevalance of a breed in a community is good evidence that it is adapted to that area and that it is suitable for the local market for milk or milk products. The securing of foundation animals by a new breeder is usually easier and less expensive if they can be purchased nearby. Less time is required in locating the animals, and the cost for transportation is not so great.

A beginner can many times use the services of his neighbor's sire if he is using the same breed of cattle. When a breeder or dairyman has sold some animals to a beginner in his locality, he will have the opportunity to assist him and see that he gets a good start in developing his herd.

The selection of a single breed in a community is one more factor to help develop community spirit. This may result in many phases of dairy development through organized groups, such as cooperative bull associations, dairy herd improvement associations, and boys and girls dairy clubs. Such groups may help in developing a market for the milk produced. Also there is a great advantage when there is a surplus of cattle to sell, if several dairymen in a community have the same breed. Buyers are attracted to the areas where they can find a number of cattle in nearby herds.

TABLE 11—HIGH BUTTERFAT PRODUCERS IN UNITED STATES OF EACH BREED

Breed	Name of Cow	Pounds of fat
Ayrshire	Cacapon Nita by Caesar 145107	1,026
Brown Swiss	Illini Nellie 26378	1,200
Guernsey	Cathedral Rosalie 334299	1,215
Holstein	Carnation Ormsby Butter King 1165182	1,402
Jersey	Stockwell's April Posis of H. P. 694544	1,218

Market Demands:—The market requirements have some bearing on the selection of a breed. However, this does not usually demand great emphasis since nearly all markets pay for milk on a differential basis which practically equalizes the price paid for milk of varying butterfat content.

There are times in the economic cycle when the scale of prices fails to equalize for all milk. In times of rising prices the low testing milk generally has a price advantage on the differential basis; on the other hand, when prices are declining the high fat milk may have a price advantage. All of the breeds are so widespread now that there is not the market advantage that apparently existed several years ago.

In cream producing areas, high butterfat testing breeds usually predominate. However, even in these areas, low testing breeds are maintained by some dairymen, because they need a large amount of skim milk for use in growing calves, pigs, and chickens. The low testing breeds are more numerous in sections surrounding cheese factories and condenseries.

All the breeds supply the milk for distribution of fluid milk. Milk marketed in bottles usually contains four percent butterfat which is the result of the distributor blending milk from herds of the various breeds. Each of the breeds does have its special milk which is marketed without mixing with milk of other breeds. This, however, is a minor part of the total milk marketed.

Personal Preference:—After other factors have been considered, if they do not weigh heavily enough to make a decision, the personal preference factor should be used to determine the breed. There may be many varied reasons back of a preference, however, association with a breed is the greatest influence in

causing a person who loves good cattle to prefer a particular breed. It may be the efficiency of a herd composed of that breed, or it may be the splendid showing that a herd has made on the show circuit.

The breed literature that is in a man's hands can not be overlooked as an influenee on individual preference. The matter of success depends largely on a good cow, properly fed and cared for by someone who likes good cattle. A dairyman must be willing to see (1) that his eattle are fed and milked regularly; (2) that they are given his personal attention; and (3) that their eomforts are looked after many times before his own. Every effieient herd must have a good caretaker baek of it.

TABLE 12—AVERAGE YEARLY PRODUCTION OF MILK AND BUTTERFAT OF THE COWS OF DIFFERENT BREEDS THAT HAD OFFICIAL YEARLY RECORDS TO JAN. 1, 1941

Breeds	Advanced register or register of merit			
	Records of cows and heifers	Milk	Butterfat	
			Quantity	Test
	Number	Pounds	Pounds	Percent
Ayrshire	7,129	10,469	416	4 0
Brown Swiss	1,195	13 669	562	4 0
Guernsey	64,976	10,105	502	5 0
Holstein-Friesian	45,445	16,737	574	3 4
Jersey	63,014*	8,584	450	5 4

*Includes 31 628 records of 305 days in length
U. S D. A Farmers Bul. 1443

The Jersey Breed

The Jersey breed of dairy cattle was developed on the Island of Jersey located in the English Channel. This is one of the Channel Islands, along with Guernsey, Alderney and Sark. They are located between the coast of Franee and England.

It is reported that the Jersey Breed has been kept pure for over five hundred years. In order to keep the cattle pure, a law was passed in 1789 which prohibited

Courtesy Ext. Ser. U. S. D. A.

Fig. 56. A Jersey Cow. This prize winning Jersey cow is owned by the Granada Farms in Caldwell County, North Carolina.

the taking of any cattle to the island except for immediate slaughter.

The agriculture of the Jersey Island is very intensive. It is an area of about 60 square miles, with a population of more than 50,000 people. It maintains an average of over 10,000 head of Jerseys. Exportation of cattle from the island has run as high as a thousand head per year, many of these have been brought into the United States. Some importations of Jerseys to this country have been reported as occurring soon after the year 1800. They were then known as Alderneys. There are records of cattle coming from the Jersey Island in 1850 that were kept pure and their offspring entered in the herd register.

In 1868 a few breeders, who had Jersey cattle and wished to secure means of keeping them pure, formed the American Jersey Cattle Club. They set up regulations governing the registration of cattle imported from the Jersey Island and their offspring. The herd register was established to keep records of pedigrees of the registered animals. The Jersey Bulletin

is the breed paper and publishes the news and accomplishments of the breed. Jerseys are well established in all parts of this country, however, they have their greatest predominance in the South.

Characteristics:—Cattle of this breed are smaller in size than cows of any of the other major dairy breeds. The cows usually weigh from 900 to 1100 pounds and the bulls from 1300 to 1600 pounds. Animals of this breed are very refined with extreme dairy type and dairy temperament.

The most universal color is some shade of fawn which varies from very light to almost black. Quite a few Jerseys have white spots, which are not favored by some breeders.

There is a great divergence of type between the American type and the Island type. The American type cattle are those that have descended from early importations, especially from the St. Lambert breeding. These animals are larger and coarser, and lack the beauty and refinement of the Island type, but on the average produce more milk and butterfat. The Island type is smaller with finer bones and are cleaner cut throughout than the American type. These include the more recently imported cattle and their descendants. This type is favored in the show ring.

When the Germans occupied the Channel Islands during World War II, the number of cattle was reduced. The cattle population is now increasing and some Jersey cattle are being exported to the United States.

Because of small size and low maintenance requirements along with the richest milk of any of the breeds, the Jersey can produce butterfat at a low cost per pound. The cost per hundred pounds of milk is higher than some other breeds. Jersey milk is sometimes sold as special breed milk on the retail market under the

Courtesy J. A. Arey, N. C. State College Extension Dairyman
Fig. 57. A Jersey Bull. This is a good type Jersey bull. Superior animals are essential factors on the modern dairy farm.

breed's trademark "Jersey Creamline Products." The average test of all register of merit cows is 5.36% fat.

The Jersey is a splendid grazer. She is able to maintain herself and produce some milk on mediocre pastures which has given her an advantage over some other breeds. She must, however, be liberally fed for optimum efficiency.

Breed Families:—There are many families and strains within the breed. Most Jersey families have developed from a foundation bull, while the Guernsey and Holstein breeds have developed largely from foundation cows. The blood lines have been crossed a great deal so that many of the older families have not been kept intact. As a result, newer blood lines have been established.

The most noted families of the American type are the St. Lamberts, St. Mawes, Sophie Tormentors and Golden Glow. Families that have been developed along the Island type have descended largely from Imp. Golden Fern's Lad 65300. Among the earlier families of

this type were Golden Ferns, Golden Jollys, Flying Foxes and Eminents. Some of the later families are Majestys, Sybils, Owl-Interest, Raleighs, Nobles, Fauvic Prince, Blondes, Designs, Day Dreams, and Volunteers.

Register of Merit:—The American Jersey Cattle Club has as one of its divisions the testing of cows for milk and butterfat production. This is called the Register of Merit. To be admitted cows must produce the amount of butterfat listed in Table 13.

TABLE 13—REQUIREMENTS FOR REGISTER OF MERIT

Class	Age at beginning test	Length of record Number of days	Calving Requirements	Pounds butterfat
A	2 years	305	None	250 5
A	5 "	305	None	360 0
AAA	2 "	305	*	250 5
AAA	5 "	305	*	360 0
A	2 "	365	None	290 5
A	5 "	365	None	400 0
AA	2 "	365	**	290 5
AA	5 "	365	**	400 0

*Must calve within fourteen months of previous calving.
**Must calve within sixteen months of previous calving
NOTE. For each day over two years of age at beginning of test, the requirement is increased one-tenth pound of fat until the cow is five years old

There are three medal awards for production. To receive a silver medal a cow under five years old must produce 420 pounds of fat in class AAA beginning at exactly two years of age with an increase of .175 pounds for each day increase in age up to five years. In class AA the production requirement is 1.15 times the requirement in AAA. For gold medal recognition a cow of any age must produce 610 pounds fat in AAA or 700 pounds in AA. A few cows have received the medal of merit award, the requirements being 740 pounds of fat in class AAA or 850 pounds in class AA.

A bull is designated a medal bull when he has three daughters that have qualified, and the kind of medal depends on the ones the daughters received. An A. J

C. C. tested sire is one who has ten or more daughters that have completed records. There is also a herd test, where all cows in the herd are tested for production.

Herd Classification:—To improve the type of the Jersey breed and to make available type ratings on herds that are not shown at fairs, a system of herd classification has been set up. A few designated judges act for the club in placing a type rating on each animal in herds where the owner applies for this service. The classification is made in six groups, excellent, very good, good plus, good, fair, and poor. Animals classifying poor have their registration papers cancelled and those rating fair cannot have male offspring registered.

Promotion of Breed:—Fieldmen for the breed work with breeders to help them with their problems and to promote the breed. Many state clubs are active in improving and advancing the breed. The activities may include promoting field days, breed meetings, shows, 4-H and F.F.A. projects, artificial breeding associations, and many other phases of breed advancement.

The Guernsey Breed

The Guernsey breed was developed on the Island of Guernsey. This island is located in the English Channel and is farther north than Jersey. The original cattle from which the Guernseys were developed were probably quite similar to those from which the Jerseys were developed. This island is smaller than Jersey but has the same population per square mile. It maintains from 7,000 to 8,000 head of Guernseys. The Island was occupied by the Germans in 1940. While many animals were slaughtered, the majority were maintained for their milk supply and the numbers are now being replenished. While vegetable culture, especially under glass is their chief farming enterprise, their cattle re-

Courtesy The American Guernsey Cattle Club

Fig. 58. A Guernsey Cow. This is Quail Roost Queen Celeste (41:2), owned by George Watts Hill, Quail Roost Farm, Rougemont, N. C. As a junior two-year-old she produced 11,386.6 pounds of milk and 552.9 pounds of butterfat, and at the 1940 National Dairy Show won first prize as a four-year-old cow and the award of Reserve Grand Champion female. She has also won grand championship honors at the Virginia State Fair and twice at the North Carolina State Fair.

ceive a great deal of attention. They are kept in very small herds and fed largely on roots and forage crops. There were laws passed in 1824 prohibiting the importation of cattle to the island except for slaughter. However, prior to this date the Guernsey cattle had been kept pure over a long period of years.

The first importation to America was made in 1831. Several importations were made during the period 1870 to 1880. The American Guernsey Cattle Club was organized in 1877. A herd book was set up to keep a record of the pedigrees of registered animals. This association publishes its own breed paper, the Guernsey Breeders' Journal. Guernseys are distributed throughout the entire United States, but they have their greatest points of development along the Atlantic coast.

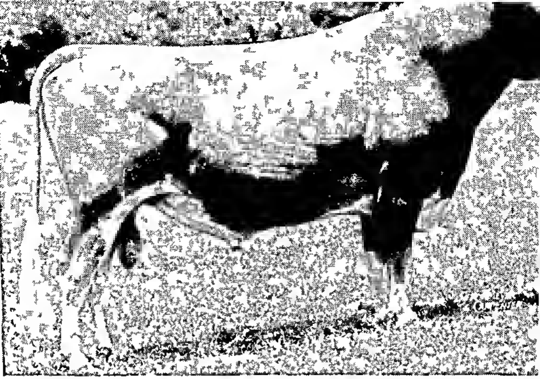
Characteristics:—Guernsey cattle are larger than the Jersey, the mature cow averaging around 1100 pounds in weight and bulls from 1400 to 1800 pounds. They are usually of a dark fawn color with white markings. The fawn may range from a very light to a dark red fawn. A buff colored nose is typical. A smutty or black nose is discriminated against by breeders.

Guernseys are of a more rugged build than Jerseys, but they are not so uniform in type nor do they have as shapely udders. They are noted for the large nmount of secretion in the skin. One of their most valuable qualities is the deep yellow color of their milk and milk products. A large number of breeders are marketing their milk under the breed trademark "Golden Guernsey."

The average test for the advanced registry cows is 4.98% butterfat. The natural yellow color of the milk of Guernseys has helped to make the breed very popular. The most rapid development has been in the fluid milk areas. The rapid expansion of the breed has not been conducive to as much selection ns is desirable in improving a breed. Very few cattle have been imported during the last ten years. The development has come through the use of American bred cattle.

Families:—There are not as many distinct Guernsey families as in some other breeds. A large percentage of the cattle today has descended from May Rose 2nd, the foundation cow of the May Rose family, developed by Langwater Farm. Some other families are Glenwood Girl, The Chene, Cherub, Masher, France, Sequel, Butterfat, Foremost and Maxim.

Advanced Registry:—The advanced registry is an additional registration of cows that have met certain production requirements and of bulls that have five daughters that have qualified. The requirements vary with age and length of record.



Courtesy The American Guernsey Cattle Club

Fig. 59 A Guernsey Bull. This is Argilla Knight (31·41:62), —owned by Thurmond Chatham, Klondike Farm, Elkin, N. C This sire has full performance and breeding information on 62 sons and daughters published in the Performance Register of the American Guernsey Cattle Club His 52 tested daughters have 73 official records averaging 11,951 6 pounds of milk and 599 pounds of butterfat Sixty-four of these records were made at immature ages. He is the sire of Klondike Jette that produced 19,678 pounds of milk and 1,010 pounds of butterfat in 1941.

Records are reported under standard classifications. They are based on (1) the age of the cow at the time of calving—that is, her age before the record is started, (2) number of times the cow is milked per day, and (3) the length of the record.

Classification based on age at time of calving:

Yearling	under 2 years
Junior Two-year-old	2 and under 2½ years
Senior Two-year old	2½ and under 3 years
Junior Three-year-old	3 and under 3½ years
Senior Three-year-old	3½ and under 4 years
Junior Four-year old	4 and under 4½ years
Senior Four-year-old	4½ and under 5 years
Mature	5 years and older

Classification based on number of times milked daily:

2X	cows milked twice daily
3X	cows milked three times daily
4X	cows milked four times daily

Classification based on length of record:
10 months, or 305 days
12 months, or 365 days

There are also designations showing whether or not the cow carried a calf during the time she made her record.

There is a system of herd testing in which all cows in the herd are included in the test.

Promotion of Breed:—The association maintains fieldmen in various sections of the country to promote the breed and to assist breeders with their problems. They can be of service in promoting sales, selecting herd sires and foundation females, and working with organized groups in various activities. State clubs form a nucleus through which the fieldmen may work.

The Holstein-Friesian Breed

The Holstein-Friesian breed, generally called simply Holstein had its origin in The Netherlands. This type of cattle has been kept in this part of Europe for probably 2,000 years. It is one of the oldest breeds. Animals of this breed have contributed to the development of some other breeds.

The environment under which the Holstein was developed, undoubtedly had considerable influence on the type of cattle selected. The lowlands were reclaimed from the sea, by the building of dykes and pumping the water from the land by windmills. The soil is very fertile and produces luxuriant pastures and hay crops. These furnish most of the feed consumed by the cattle.

There are reports that indicate that Holstein cattle were brought to America as early as 1621. Some that were imported in 1861 were kept pure and formed the

Fig. 60. A Holstein-Friesian Cow. This cow—Rocky Hill Dewdrop Burke (1769515)—is an excellent example of this breed. She has won a number of outstanding awards.

foundation of some of the early registered herds. The Holstein Herd Book was established in 1871. Six years later some other breeders set up the Dutch-Friesian Herd Book. These two groups were registering the same type of cattle and in 1885 they combined and formed the Holstein-Friesian Association of America.

The Holstein breed has become well established in all sections of the country, with the greatest numbers near the large fluid milk markets in the east and middle west and in areas of the middle west where milk is produced for manufacturing purposes. The breed paper is the Holstein-Friesian World.

Characteristics:—The Holstein is a large breed of dairy cattle. The mature cows average 1300 to 1500 pounds in weight and the bulls 1800 to 2200 pounds. Calves of this breed are large at birth, averaging 90 pounds or more and are very hardy. They can be grown into high grade vealers. Discarded cows also make a very good grade of beef.

The color of the Holstein is black and white, however, it may be either extreme. The breed produces the

largest quantity of milk of any of the breeds. The average test is 3.45% fat. Holstein milk contains small fat globules and is very easily digested.

In the early years of development, large numbers of of Holstein cattle were imported. Very few have been imported since 1885. Since then breeders have relied on American bred cattle. Today this breed is a more distinct dairy type than the cattle from which they descended. Holstein cows are less nervous than are Jerseys and Guernseys, and are not affected as much by change of milkers and other disturbances.

Families:—There are many families within the breed, but they have not been kept as distinct as in the case of the Jersey. The families usually have been developed from a foundation cow. Some of the more important earlier families are DeKol, Pietertje, Netherland, Clothilde, Aaggie, Johanna, Colantha, Segis, May Echo, Rag Apples, and Homestead. These have not been preserved as pure families, but most of them have contributed to later families or strains.

The most noted and widely distributed line of breeding today is the Ormsby. They are very closely related to the Bess Burkes. Many substrains of the Ormsbys and Bess Burkes have come into prominence in the last twelve to fifteen years.

Advanced Registry:—The early advanced registry work of the Holstein breed dealt with the seven day test. This was not a true indication of what a cow could produce for a year or what she could transmit. The advanced registry now is a test for either 305 or 365 day production. The production requirements are somewhat similar to the Jersey and Guernsey requirements but there are more classifications, based on age, length of record and number of times the cow is milked daily.

A bull becomes an advanced registry bull by four of his daughters qualifying. The herd improvement

Fig 61. A Holstein Friesian Bull This bull has won many prizes at Dairy Cattle Shows

registry or herd test division is becoming more popular than the regular advanced registry. In the herd test all cows in the herd are tested—usually year after year. In this way the lifetime production of the individual cow is secured A herd classification system is being sponsored by the breed association. Breeders may have their animals rated for type.

Promotion of Breed:—The breed association maintains an extension department for the promotion of Holstein activities. Their fieldmen work through state clubs and with individual breeders. Their purpose is to increase interest in the breed by improving it and popularizing it through shows, sales, youth dairy clubs, production testing and other ways.

The Ayrshire Breed

The Ayrshire breed is not as old as the three breeds previously discussed. It was developed in the county of Ayr in Scotland. Blood from Holsteins, Shorthorns and the Channel Island breeds probably was used in the development of the Ayrshire. The cattle of this

Fig. 62. An Ayrshire Cow. This animal—Cacapon Nita by Caesar—is an excellent individual of this breed.

breed were selected for good grazing ability, snugly attached udders, and for the ability to produce heavily for a rather short lactation period. Most of the production was secured on pasture, very little of which was produced during the winter period.

Cattle of this breed were brought to the United States in 1822 and some have been imported quite regularly since then. The American Ayrshire Breeders Association was organized in 1875, however, registration had been kept previous to that time by a private company. This breed is most numerous in the northeastern states, but is expanding rapidly throughout the South and other parts of the country.

Characteristics:—The Ayrshire is a very stylish breed. Cattle of this breed are hardy and are good grazers. Their type is a little more compact than some other dairy breeds. The usual color is spotted, either brown or red with white. The distinctive turning of the horns adds to the carriage of the animal. These turns are outward, upward and back for the cows with only the first two for the bulls. The breed is noted for evenly balanced udders that are strongly attached.

Fig. 63. An Ayrshire Bull. This bull—Le Maines Point Enterprise—is a good individual of this breed

The American breeders have developed the cows of this breed into more peristent milkers than were the earlier Ayrshire cattle. They are noted as long-lived cows and good year after year producers. The average test for the breed is 4 0 percent fat. Ayrshire milk has a soft curd which renders it easy to digest. In size the Ayrshire is slightly larger than the Guernsey.

Some of the more noted lines of breeding have been produced by Penhurst, Strathglass, Sycamore, Pinehurst, Lippett, Alta Crest, and Reymann Memorial herds.

The advanced registry was started in 1902, but the association stresses the herd test. The American Ayrshire Breeders Association was the first to start a herd test. The breed paper is the Ayrshire Digest. The breed association looks after the advancement of the breed. Its influence has extended quite fast in the past few years.

The Brown Swiss Breed

The Brown Swiss originated in Switzerland where a large rugged cow was essential. Only a small number have been imported into the United States but they

Courtesy Brown Swiss Breeders Association

Fig. 64. A Brown Swiss Cow. This cow, Jane of Vernon 29496, was the Grand Champion Brown Swiss Cow at a National Dairy Show. Her production record at four years of age was 23,569 pounds of milk and 1076 pounds of butterfat.

have been very prolific and their numbers are increasing very fast. They have their strongest hold in the middle west.

The Brown Swiss breed is the coarsest of the dairy breeds. They do not show as much dairy temperament as do the other dairy breeds. There is now, however, a tendency to change the type more toward a distinct dairy conformation.

The Brown Swiss cows are large, weighing on an average of around 1300 to 1400 pounds and the bulls from 1800 to 2200 pounds. It is a relatively late maturing breed. The color of this breed ranges from a brown to a light grayish color with a lighter color along the back line. Cows of this breed produce well and have increased in popularity on their ability as dairy animals. The average test of the breed is 4.0% fat.

The Brown Swiss Cattle Breeders Association was formed in 1880. While the association has maintained

Courtesy Brown Swiss Breeders Association

Fig 65 A Brown Swiss Bull. This is a picture of Septana's Concentration of Bowerhome

herd books and published information on the breed, it has not had fieldmen until the past few years. There is a Register of Production division of the association and several high records have been made by cows of this breed.

Minor Breeds

There are several minor breeds that are kept by a few breeders. Some individuals of these breeds are splendid dairy animals. The breeds as a whole have not been popularized to any great extent.

The Dutch Belted breed was developed in Holland. It was probably developed from animals of Holstein blood. The color is very distinct with a white belt between the black extremities. There is an association for the breed. The cattle are not very widespread over the country.

The Kerrys and Dexters are very small breeds, the cows weighing 600 to 800 pounds. They came from Ireland. The color is solid black. The Dexters have more milking qualities than the Kerrys which are more

of a dual purpose breed. The two breeds, however, are quite similar in many characteristics. There are very few animals of these breeds in this country.

Dual Purpose Breeds

There are some cattle that are called dual purpose, meaning that they are good milk producers and are also satisfactory for beef production. All cattle are dual purpose in the sense that they will produce milk and may also be utilized for beef. In the specialized

Fig. 66. Milking Shorthorn Cow. A good individual of a dual purpose breed.

breeds one function overshadows the other. A breeder has the opportunity to progress farther with a specialized breed than with one that is fair in both respects. Cattle of dual purpose breeds usually are not persistent milkers.

The breed given most consideration for this dual function is the Milking Shorthorn. There are a few herds which have been developed through careful breeding and selection that do produce satisfactorily.

This characteristic is usually not transmitted as true as with the specialized breed. Milking Shorthorns are used most in parts of the middle west. Many cows that are milked part of the time are not of the milking strain, the owner milking his cows when milk prices are higher proportionately than beef prices, then not milking them when beef prices are more favorable.

Red Polls and Devons are used in a limited way as dual purpose cattle. They are both English breeds. They may be expected to milk quite well for a few months after calving, but are not considered persistent milkers. There are very few animals of these breeds in this country.

SUGGESTIONS FOR STUDY

A. Questions and Problems

1. Which breeds are most popular in your community?
2. Make a list of all the breeds that are being used for milk production locally.
3. List the markets for milk and milk products that are available to your area.
4. List the breeders near you that have registered herds.
5. List the dairymen with grade herds that have a registered sire.

B. Activities

1. Visit some of the herds in your community. Find out the breed families or blood lines that each contains.
2. Find out from the owner why he chose that particular blood line.

3. Secure sale catalogs and study the blood lines and production records in the pedigrees of the sale animals.
4. If possible attend a purebred dairy cattle sale.

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CHAPTER X

GENERAL PROBLEMS IN DAIRY FEEDING

The feed cost of milk production represents a greater percent of the total cost than any other item. Economical milk production must be based in part on the efficient use of feed. Cows, with ability to consume large quantities of feed and to transform a large amount of it into milk nutrients, are essential. However, good cows not adequately fed cannot produce over a period of time. They will not produce beyond that provided for in the feed.

The feeding plan should be based on the feeds that can be grown on the individual farm. The value of a feed is based on its feed nutrient content. Pastures furnish the cheapest feed nutrients of any feed, partly because there is no cost for harvesting, storing and feeding. Farm grown roughages furnish the next most economical feed, followed by farm grains, with purchased feeds the most costly source of feed nutrients.

A cow is well equipped to utilize large quantities of roughage. For high production she needs grain or other concentrate feed in order that she may consume sufficient nutrients to supply her maintenance requirements and have enough more to produce a large quantity of milk and butterfat. In average producing herds about half of the ration is used by the cow for maintenance leaving the other half to be used for milk production.

Feed Nutrients:—The value of a feed is determined by the amount of nutrients that the cow can get from it. The chemist analyzes a feed to find the amount of the following that it contains: moisture, protein, fat, carbohydrate (divided into fiber and nitrogen-free ex-

Fig. 67. Good Breeding and Proper Feeding Produce Results. This animal, Estella Bouncing Bet 1003308, is classified as excellent. She is the only cow to make Medal of Merit requirements three times. Her production records are as follows:

Milk	Test	Fat	Class	Days	Medal Award	Age
10,856	6.91%	749.7	AAA	305	Medal of Merit	2 yr. 10 mo.
11,411	6.85%	781.8	AAA	305	Medal of Merit	4 yr. 0 mo.
14,246	5.97%	850.8	AA	365	Medal of Merit	5 yr. 2 mo.
11,507	6.25%	718.7	AA	365	Gold	6 yr. 5 mo

tract) and ash. The dairy research man determines the digestible nutrients in a feed by feeding definite amounts over a period of several days and during this time collecting the dung excreted by the cows. The part of the feed excreted is the undigested portion. The digestible part is found by the difference in the amount of each nutrient consumed and that excreted.

TABLE 14—RESULTS OF A DIGESTION TRIAL WITH A COW BEING FED ALFALFA HAY AND A CONCENTRATE MIXTURE

	Dry Matter	Total Protein	Ether Extract or Fat	Crude Fiber	Nitrogen-free extract
	Kilograms	Kilograms	Kilograms	Kilograms	Kilograms
Amount consumed	64.065	11 816	2.164	9.838	36.455
Amount in dung	17.173	3.184	0.526	4.504	6.954
Amount digested	46.892	8 632	1 638	5 334	29.501
Percent digested	73 2	73.1	75.7	54.2	80.9

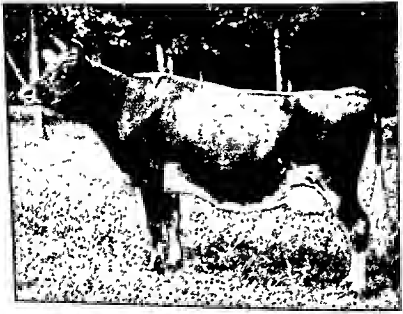
From Virginia Agricultural Experiment Station Tech. Bul. 65.

Protein:—Protein is the most expensive feed nutrient and it, many times, is the limiting factor in economical production. It differs from the other nutrients in that it contains nitrogen. The dairyman in most cases depends on purchasing feeds containing a high percent of protein to supplement farm grown feeds that are generally low in protein and high in carbohydrate content. More protein is needed for milk production than for maintaining cattle or for fattening them.

Carbohydrates:—Carbohydrates make up a very large part of the nutrients in most grains and roughages. It furnishes energy and can be converted into body fat. It also furnishes material from which milk sugar and a part of the milk fat may be produced. From a chemist's standpoint carbohydrates are divided into fiber and nitrogen-free extract. The latter is the

part containing most of the digestible carbohydrates. Only a small percentage of the fiber is digested.

A high fiber content in a feed indicates a low digestible content. However, a certain amount of fiber is essential in digestion, to keep the feed porous so that water and digestive juices may penetrate it and also to



Courtesy J. A. Arey, N. C. State College Extension

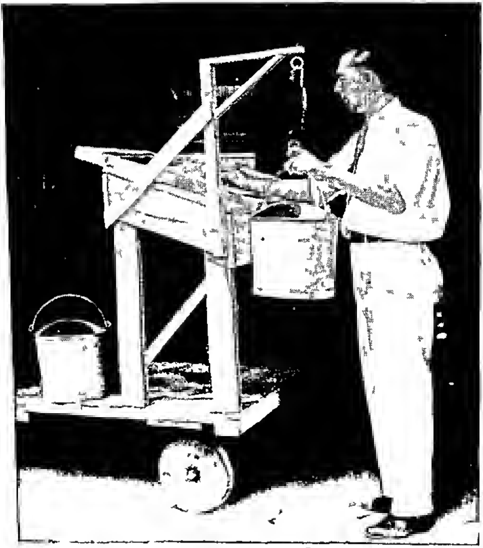
Fig. 68. Superior Animal. This Jersey cow shows the fine qualities which all good dairy animals should possess. Good breeding and good feeding must go together to produce superior, high producing animals.

aid in its passage through the digestive tract. Roughages are high in fiber content. Grains and other concentrates are lower in fiber than roughages, but they vary a great deal in their content. This is taken into consideration in preparing formulas for grain mixtures.

Fat:—Fat is an essential feed nutrient for dairy cattle, but is not needed in large quantities. Carbohydrates and excess protein can be converted into fat.

The feeding value of a feed is usually expressed in terms of its content of digestible protein and of total digestible nutrients (T.D.N.). This simplifies the calculations necessary in figuring feed requirements and feed formulas.

Total Digestible Nutrients:—Total digestible nutrients include digestible protein, digestible carbohy-



Courtesy N C State College Extension Service

Fig. 69. Record Keeping. The keeping of accurate daily records indicates production trends, improves the farmer's knowledge of his individual cows, and makes possible more intelligent feeding of animals—all of which may result in greater profits.

Courtesy Ext. Ser. U. S. D A.

Fig. 70. Holstein Cows on Pasture. A good permanent pasture greatly reduces feed costs. A few trees in a pasture are valuable to furnish shade on hot days.

drate, and digestible fat. The figure which represents the T.D.N. of a feed is determined by multiplying the percent of digestible fat by 2.25 and adding this product to the percent of digestible carbohydrate and percent of digestible protein. Fat has an energy value 2.25 times as great as that of protein and carbohydrate.

Nutrient Content of Feeds:—The content of practically all feeds has been determined by workers in agricultural colleges and experiment stations. They have also determined the digestible nutrients in many of these feeds. Different lots of a feed may differ in content, and from the average.

The figures on composition of feeds are usually the averages of a large number of analyses of the feed. The most complete tables on composition and digestible nutrient content of feeds have been compiled by Morri-

son. A number of selected feeds are listed in Table 15 with their composition as taken from Morrison's tables.

Feeding Standards:—In order for feeders to have a guide by which to feed, feeding standards have been established through feeding trials. In these trials animals that were not producing were fed varying amounts of the feed nutrients until it was found just the necessary amounts that were required to maintain constant weight, that is, they did not gain or lose in weight. This amount is called the maintenance requirements.

With the maintenance needs determined, cows in production were fed at a level that would maintain a certain flow of milk. By deducting the maintenance requirements from the total amount of nutrients used, the requirements for milk production were determined.

These investigations showed that large cows require more for maintenance than do small cows. The feeding standards, then, vary the needs according to

Courtesy Ext. Ser. U. S. D. A.

Fig. 71. Pastures Furnish Cheap Feed. Usually the cheapest and best roughage feed that can be produced on a farm is that which comes from a good pasture. Good pastures and profitable dairy farming go together.

TABLE 15—AVERAGE COMPOSITION AND DIGESTIBLE NUTRIENT CONTENT OF FEEDS

(Taken by special permission of the Morrison Publishing Company, Ithaca, N. Y., from Feeds and Feeding, 20th Edition, by F. B. Morrison)

	Dry Matter	Protein Total	Protein Digestible	Tot. Dig Nutrient	Fat	Fiber
Hays	%	%	%	%	%	%
Alfalfa	90.4	14.7	10.8	50.3	2.0	29.0
Clover, Red	88.2	11.8	7.0	61.9	2.8	27.3
Clover, Sweet, 1st year	93.3	19.5	14.6	53.5	2.9	21.0
Clover and Timothy	88.0	8.6	4.4	48.0	2.3	30.1
Corn Stover, ears removed	81.0	6.7	2.1	46.2	1.2	27.7
Cowpea	90.4	18.6	12.6	49.4	2.8	23.3
Lespedeza	89.1	12.8	9.2	52.2	2.3	26.2
Oats	88.0	8.3	4.5	46.3	2.7	28.4
Soybean	90.8	14.8	11.1	50.6	3.3	28.4
Sudan Grass	89.2	8.8	4.3	48.5	1.6	27.9
Timothy	88.7	6.2	2.9	46.9	2.4	30.1
Vetch, Common	91.5	13.6	9.1	57.8	1.1	26.0
Pastures						
Pasture grasses and clovers closely grazed, fertile pastures	28.7	6.7	4.4	20.6	1.1	6.4
Pasture grasses and clover mixed fertile pasture, Southern States	21.4	3.7	2.6	16.1	0.6	6.6
Pasture grasses, mixed from poor to fair pasture, before heading	30.2	4.7	3.3	19.6	0.8	6.6
Silages						
Alfalfa, wilted before ensiling	54.0	10.0	5.1	29.0	2.5	14.2
Corn, dent, well matured	28.3	2.3	1.3	18.7	0.9	6.9
Corn and Soybeans 2 1	28.1	3.1	2.0	19.5	1.1	7.2
Pea and Oat	30.0	3.6	2.7	19.2	1.2	9.4
Soybean	27.2	4.2	2.6	16.0	1.6	7.9
Vetch and Oats	26.4	2.2	1.7	16.7	0.6	8.8
Concentrates						
Barley	90.4	11.8	9.3	78.7	2.0	5.7
Beet pulp-dried	92.0	9.0	4.8	71.8	0.8	18.8
Brewers grains, dried	93.9	23.8	19.6	65.2	6.6	14.9
Corn, dent—No. 2	65.2	9.4	7.1	80.6	3.9	2.2
Corn and Cob Meal	88.6	8.2	6.0	75.9	3.3	8.2
Corn gluten Feed	90.6	26.4	22.7	77.4	2.6	7.1
Corn gluten Meal	91.6	42.9	66.6	81.8	2.3	2.6
Cottonseed Meal 41%	93.0	41.6	63.9	73.6	7.0	9.9
Distillers' corn grains	93.8	60.6	22.3	85.0	10.8	10.8
Hominy Feed	90.9	11.0	7.6	85.2	6.9	4.8
Linseed meal	91.3	65.2	30.6	78.2	6.3	8.0
Molasses, cane	74.1	2.8	0.9	66.6	—	—
Oats	91.1	12.0	9.4	71.6	4.7	10.6
Peanut oil meal	93.5	43.4	38.8	80.9	8.2	10.0
Soybean oil meal	91.7	44.6	37.7	82.2	6.7	5.6
Wheat	89.8	13.1	11.6	83.6	1.7	3.0
Wheat bran	90.6	15.8	13.1	70.2	6.0	9.5
Wheat Middlings	90.0	17.4	14.4	78.4	6.6	6.8

the weight of the cow. It was also found that the amount of nutrients required to produce a pound of milk varied with the fat content of the milk. The feeding standards, accordingly, call for different requirements for various percentages of fat in milk.

The feeding standards given in Tables 16, 17, and 18 are according to Morrison's standards and are taken from the twentieth edition of Morrison's Feeds and Feeding. The amounts represent the needs for one day

Morrison's Feeding Standards

TABLE 16—MAINTENANCE REQUIREMENTS FOR DAIRY COWS (Per Day)

Weight of Cow	Recommended for good cows under usual conditions	
	Digestible Protein	Total Digestible Nutrients
Pounds	Pounds	Pounds
700	476	5 81
800	536	6 53
900	593	7 23
1 000	650	7 93
1,100	706	8 81
1 200	762	9 29
1 300	817	9 97
1 400	872	10 63
1,500	925	11 28
1 600	979	11 94
1,700	1 032	12 58

Taken by special permission of the Morrison Publishing Company, Ithaca, New York, from *Feeds and Feeding*—20th Edition, by F B Morrison

TABLE 17—REQUIREMENTS FOR MILK PRODUCTION PER POUND OF MILK (Above Maintenance)

Test of Milk	Recommended for good cows under usual conditions	
	Digestible Protein	Total Digestible Nutrients
Percent Fat	Pounds	Pounds
2 5	040	251
3 0	043	275
3 5	046	300
4 0	049	324
4 5	052	349
5 0	056	373
5 5	059	397
6 0	062	422
6 5	065	446
7 0	068	470

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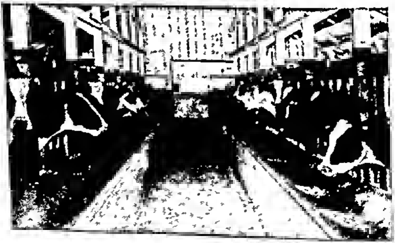
TABLE 18—REQUIREMENTS FOR GROWING DAIRY CATTLE (Per Day)

Weight of heifer Pounds	Dry matter Pounds	Digestible Protein Pounds	Total Digestible Nutrients Pounds
100	1.4- 2.4	.24- .40	1.2- 2.0
150	3.0- 4.0	.41- .62	2.3- 3.0
200	4.6- 5.6	.62- .62	3.3- 4.0
250	5.9- 6.9	.61- .71	4.1- 4.8
300	7.2- 8.0	.67- .78	4.9- 5.5
400	9.0-10.0	.80- .90	6.1- 6.6
500	10.6-11.8	.87- .98	6.9- 7.7
600	12.0-13.6	.94-1.06	7.7- 8.7
700	13.4-15.5	1.00-1.13	8.4- 9.7
800	14.8-17.4	1.06-1.20	9.1-10.7
900	16.1-19.2	1.11-1.27	9.8-11.7
1000	17.5-21.0	1.16-1.33	10.4-12.6

Taken by special permission of the Morrison Publishing Company, Ithaca, New York, from *Feeds and Feeding*—20th Edition, by F. B. Morrison.

To calculate the daily needs of a producing cow, it is necessary to use two tables. For a 1200 pound cow producing 40 pounds of 4.0% milk daily, her needs can be determined as follows: From Table 16 it is found that a 1200 pound cow requires .762 pounds of digestible protein and 9.29 pounds of T.D.N. for maintenance. Then, by consulting Table 17 it is found that



Courtesy Ext. Ser. U. S. D. A.

Fig. 72. Feeding Time. The concentrates are being fed to these cows while in the milking barn. This makes possible individual feeding.

for each pound of 4 0% milk that is produced the cow needs .049 pounds of digestible protein and .324 pounds of T.D.N. The requirements for forty pounds can be obtained by multiplying each of these figures by forty. Finally the total requirement is secured by adding the needs for maintenance to the needs of milk production. This is illustrated in Table 19.

TABLE 19—NUTRIENTS NEEDED BY A 1200-POUND COW PRODUCING 40 POUNDS OF 4.0% MILK DAILY

	Digestible protein Pounds	Total digestible nutrients Pounds
For maintenance of a 1200 lb cow	762	9 29
For producing 40 lbs of 4 0% milk	1 960	12 96
Total Requirement	2 722	22 25

To find the nutrient requirements of growing heifers, see Table 18. A range of figures is given in this table. For normal growth an average of the two figures should be used. If it is desired to grow heifers faster the higher figure should be used. Likewise, if feeds are high and the feeder prefers to feed lighter and allow more time for the animal to mature, the lower figure should be used.

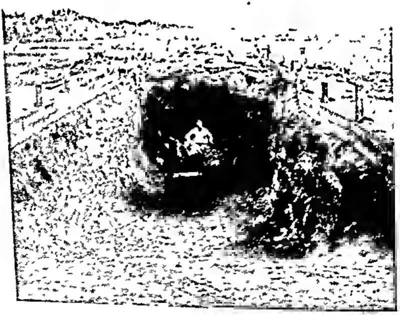
The dry matter recommended in Table 18 will serve as a guide for the proportion of concentrates and roughages. This is especially useful in calculating rations for calves, since they are limited in the amount of roughage that they can utilize. On the other hand, yearling heifers should receive sufficient roughage to develop a good sized barrel.

TABLE 20—REQUIREMENTS FOR GROWTH FOR A 300-POUND AND A 700-POUND ANIMAL FOR NORMAL GROWTH (Per Day)
(Morrison's Standard)

Weight of Animal	Dry Matter Pounds	Digestible Protein Pounds	Total Digestible Nutrients Pounds
300 pounds	7 2– 6 0	67– .78	4 9–5 5
700 pounds	13 4–15 5	1 09–1 13	8 4–9 7

Balanced Rations:—A ration is the amount of feed given an animal for one day—a period of 24 hours. The feeding of a balanced ration is supplying the needed amount of nutrients, in the proper proportions, to an animal. If the amounts called for in the standards are used, a balanced ration is fed. Feeding an unbalanced ration is not an economical utilization of feeds. The animal can use efficiently only that part of the feed that is correctly balanced.

The method of balancing a ration by the use of data in the standards may be illustrated by putting together certain feeds to meet the requirements of a 1200-pound cow, producing 40 pounds of 4.0% milk daily as given



Courtesy Ext. Ser. U. S. D. A.

Fig. 73. Feeding Silage. Here the farmer is loading silage from a trench silo which is to be fed to cattle. The use of trench silos is increasing in the South. Silage makes an excellent succulent feed during winter months when pastures are not green.

in Table 19. To do this red clover hay, corn silage, and a concentrate mixture may be used. Table 15 may be referred to for the digestible protein and T.D.N. in the hay and silage, and then a concentrate mixture of 11.5% digestible protein and 72% T.D.N. may be assumed.

If 40 pounds of corn silage and 12 pounds of red clover hay are used, then it will be necessary to add 12 pounds of the concentrate mixture to supply the needs of this cow.

TABLE 21—AMOUNT OF FEEDS REQUIRED TO MEET NUTRIENT REQUIREMENTS OF A 1200-POUND COW PRODUCING 40 POUNDS OF 4.0% MILK

	Digestible protein Pounds	Total digestible nutrients Pounds
Requirements	2 722	22 25
Red Clover Hay—12 lbs	84	6 228
Corn silage—40 lbs	52	7 480
Concentrate mixture—12 lbs (11 5% D P 72% T D N)	1 38	8 640
Total nutrients furnished	2 74	22 348

To meet the needs of a 300 pound calf making normal gains, six pounds of red clover hay, two pounds of corn, and one-half pound of soybean oil meal may be fed. These feeds will supply the nutrients needed. It is not too bulky as can be seen by checking on the dry matter furnished.

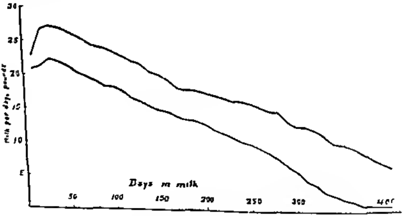
TABLE 22—AMOUNTS OF FEEDS REQUIRED TO MEET THE NEEDS OF A 300-POUND HEIFER

	Dry matter Pounds	Digestible Protein Pounds	Total digestible nutrients Pounds
Requirements	7 2-8 0	67- 78	4 9-5 5
Red Clover hay, 6 lbs..	5 292	420	3 114
Corn—No 2, 2 lbs	1 704	142	1 612
Soybean oil meal, 5 lb (41%)...	458	188	411
Total nutrients furnished. ..	7 454	750	5 137

Other Factors Affecting Value of Feeds

In addition to amounts of protein, carbohydrates and fats needed by dairy cattle, there are other factors that have an influence on the value of feeds. These additional factors are not taken into account in feeding standards dealing with protein and total digestible nutrients.

In certain areas mineral supplements are of great importance. Vitamins are necessary for growth, development, milk production and reproduction. Some feeds are high in vitamin content, while others are deficient. It is essential that the protein be of good quality. Some proteins are not made up of the essential amino acids. Protein quality will be taken care of if the ration contains some legume hay and a concentrate



Courtesy Florida Agricultural Experiment Station

Fig. 74. Bonemeal as a Supplement. Average daily milk yields of 12 Jersey cows before and during use of bonemeal as a supplement to low-calcium rations. The upper curve represents 22 lactations on the supplemented and the lower curve 44 lactations on the unsupplemented rations, computed to a uniform age basis.

(Note: These results were secured when cows had been fed on low-calcium feeds. This is a somewhat local condition. Similar increase in milk production would not be expected where cows are fed from crops grown on limed and fertilized soils.)

mixture containing, in addition to farm grains, some high protein supplement, as linseed meal, cottonseed meal, soybean oil meal or peanut oil meal.

Minerals:—In some areas, the soils are deficient in mineral content and the crops that are grown on them are low in certain mineral elements. In dairy cattle feeding calcium and phosphorus are the ones that are most important. Cows secrete a large amount of these two minerals in their milk. In general, cows producing up to 300 or 350 pounds of fat yearly should secure a sufficient amount of calcium and phosphorus from a normal feeding of a ration that is adequate in other respects. Legume hays grown on land that is well limed are quite high in calcium. A concentrate mixture containing some protein supplement as wheat bran, cottonseed meal or linseed meal will supply a large amount of phosphorus.

If low grade roughage and cereal grain concentrates make up the entire ration some supplement of calcium and phosphorus will be needed. High producing cows, even on rations adequate in other respects may need an addition of these two minerals. One of the most common mineral supplements used is steamed bone meal, which supplies both calcium and phosphorus. Raw bone meal is not recommended as it is not always safe to feed. Dicalcium phosphate is being used for supplying both minerals. Finely ground limestone is the cheapest source of calcium. Rock phosphate or lime phosphate should not be used unless it is known to contain only a very small amount of fluorine. A very minor content of fluorine (above .3%) in the phosphate may produce injurious effects on the teeth and bones of the animal.

Sodium chloride or common salt is essential and can be fed as a part of the concentrate mixture or cows may be allowed free access to it. It is advisable to put

one percent in the grain mixture and also allow free access to it. A milking cow will need from one to three ounces of salt per day, depending on how heavily she is milking. Steamed bone meal or other supplements may be put in the concentrate mixture at the rate of one percent. Another satisfactory method is to mix equal parts of bone meal and salt or equal parts of bone meal, finely ground limestone and salt and allow free access to it.

Courtesy Ext. Ser. U. S. D. A.

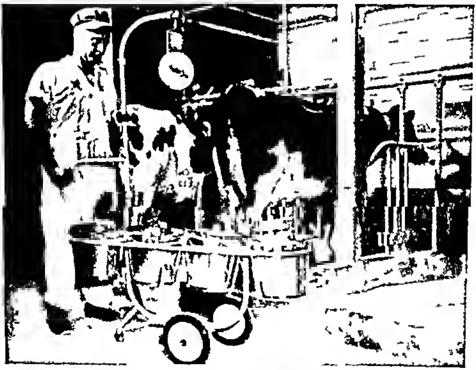
Fig. 75. Fresh Clean Water Essential. Note the drinking cups attached to the stanchions. Fresh, clean water in abundance is essential for maintaining high production in a dairy herd. Drinking cups as shown by this picture give cows free access to water while fastened in stanchions.

Cows receiving inadequate minerals drop in production and may be slow breeders. Phosphorus deficiency shows up by poor condition of the cow and a depraved appetite resulting in the animal chewing bones, wood or dirt. In calcium deficiency, production

drops and the bones become weak, however, the cow may remain in good condition of flesh. Calves that do not receive enough calcium or phosphorus or a sufficient amount of vitamin D develop rickets.

In a few areas iodine has been found deficient. This shows up by big neck or goiter in calves and hairlessness in pigs. Feeds imported from these areas may cause these deficiency troubles. The feeding of iodized salt will prevent it.

Vitamins:—Vitamins play an important part in nutrition. They are of considerable economic value in dairy cattle feeding. Calves require vitamin A for normal growth and health. Vitamin D is needed in conjunction with calcium and phosphorus to prevent



Courtesy U S D A Extension Service

Fig 76 Milk Cart. This is a handy type of milk equipment cart. Note the scales for weighing milk Cows should be fed exact amounts of feed—according to the amount of milk produced. The pails contain warm water for washing the udders and also sterilizing solutions in which to dip the teat cups

rickets in calves, and the utilization of minerals by all classes of cattle.

The vitamin A and D content of milk is of commercial importance. The amount of these in the milk is affected by the amount in feed. Vitamin A is associated with carotene, which is yellow in color and the carotene content of milk is correlated with the amount of yellow color in milk. Milk produced on good pasture has a large amount of yellow color and high carotene content. Green, leafy hay is high in carotene content. Grass silage preserved with molasses, acid, or by the wilting method is high in carotene. These feeds will produce milk with a high carotene content.

Hays that are over ripe, rained on or bleached carry very little carotene and produce a very light colored milk. Cows fed hays of this low quality, as the only roughage, over a long period of time will produce weak calves and the milk they produce will be too low in vitamin A to sustain normal growth in calves. The table below shows the results of such trials carried out by the United States Bnreau of Dairy Industry.

TABLE 23—RELATION OF FEED OF THE COW TO THE CAROTENE CONTENT OF THE BUTTERFAT WHICH SHE PRODUCES

Roughage fed	Carotene content of butterfat. Units per gram
Pasture with alfalfa hay	4.5
Extra green alfalfa hay (15 lbs.)	3.3
No. 2 timothy hay and 15 lbs. carrots	2.6
No. 1 alfalfa hay (15 lbs.)	2.0
No. 1 timothy hay (15 lbs.)	1.6
No. 3 timothy (15 lbs.)	.4

From U.S.D.A. Bureau of Dairy Iudustry—BDIM-681.

Like vitamin A, vitamin D is largely supplied by rougbages rather than concentrates. Milk is higber in vitamin D in summer than in winter. Its content can be increased by feed supplements snch as irradiated yeast. Vitamin D may be supplied to calves, if needed,

in the form of cod liver oil or viosterol. Carotene concentrates or cod liver oil will supply vitamin A. Normal feeding will supply sufficient vitamins B, G and C.

The lack of vitamin E affects reproduction in some animals. Definite information as to its needs in dairy cattle is not available. If there is a need, apparently, normal feeding takes care of it.

SUGGESTIONS FOR STUDY

A. Questions and Problems

1. Is there a sufficient quantity of legume hay grown in your community?
2. What grains are grown locally for dairy cattle feeding?
3. Prepare a list of high protein roughages, low protein roughages.
4. Prepare a list of low protein and high protein concentrates that are fed by nearby dairymen.
5. Why is it economical to feed a ration with the correct proportion of protein and total digestible nutrients?
6. By referring to the table of composition of feeds, and using current prices, calculate the cost of a pound of digestible protein in three high protein concentrates and three legume hays.
7. By the same method calculate the cost of T.D.N. in the grains and in three hays.
8. Calculate the feed requirements of a 900-pound cow producing 25 pounds of 5.0% milk. List a ration that will supply the needs.

B. Activities

1. Make a trip to a dairy farm. List the feeds that the dairyman is feeding.
2. From the composition table, tabulate the analysis of the feeds listed in 1 above.
3. At local prices which of the feeds is the cheapest source of T.D.N.?

C. References

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CHAPTER XI

FEEDING PRACTICES

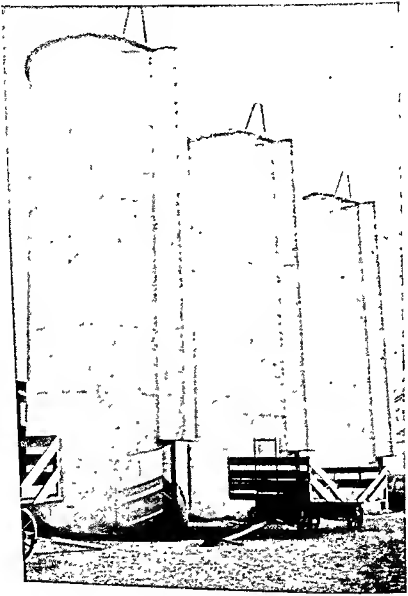
It is common knowledge that maximum milk production is reached in May and June. At this time the cow is supplied with abundant succulent grass and is not subject to the extremes of heat or cold. The aim of a good dairyman should be to maintain these conditions as nearly as possible throughout the year. The cow will pay dividends for shade or other retreats from extreme heat, for protection against cold, and for a supply of fresh water available several times per day.

Feeding for Milk Production

A suitable ration must be supplied if the cow is to maintain her optimum production. A satisfactory ration should:

1. Supply sufficient nutrients,
2. Supply nutrients in the needed proportion,
3. Be palatable,
4. Contain a variety of feeds,
5. Contain a succulent feed,
6. Supply protein of high quality,
7. Supply needed minerals,
8. Supply necessary vitamins,
9. Contain sufficient bulk,
10. Have the proper proportion of roughages and concentrates, and
11. Be economical in cost.

The supplying of balanced rations has already been discussed. Palatable feeds will give better results than feeds that the cow does not like. Unpalatable feeds will not be consumed in large amounts, a common example of this would be timothy hay and corn stover as com-



Courtesy Ext. Ser. U. S. D. A.

Fig. 77. Upright Silos. If pastures are not available in winter months, silage is the cheapest way to furnish succulent feed to dairy cows.

pared to legume hay and silage. Variety in a ration will render it more palatable. This, also, will usually take care of the quality factor for proteins. Succulent feeds are themselves palatable and help make the whole ration palatable. They also furnish water which aids the cow when she cannot get water at short intervals. The water helps to move feed through the digestive tract. The cost may be the determining factor in a feed. Regardless of how good the feed is, if it cannot produce milk economically, it should not be used.

Roughage:—The basis for all dairy rations should be roughages or pasture. The latter is discussed in Chapter XII. Succulent roughages and hays are the cheapest sources of feed nutrients for barn feeding. Cows are equipped with a digestive system to handle large quantities of roughage. Medium production can be produced on high quality roughage alone. High producing cows, however, cannot consume sufficient nutrients in the form of roughages to supply all their needs for milk production. Grain feeding is necessary to allow the cow to utilize all her inherited ability to produce milk.

With a large percent of dry roughages, the quality is the limiting factor as to the amount consumed and the amount of milk it will produce. To have the greatest milk producing value a hay must be cut early and cured so as to retain its leaves and green color.

Silage:—Succulence in winter rations where pastures are not available is furnished most cheaply with silage. Corn and sorghum silages have been used most widely, but in recent years grass and legume silage has rapidly come into use. A combination of hay and silage is more productive than either alone.

Levels of Feeding:—Some herds are fed entirely on high quality roughages, without any grain supple-

ments. Production is not as high as with supplemental feeding. Which of these systems of feeding is more profitable will depend on the cost of the supplemental feed and on the value of the additional milk produced.

The United States Bureau of Dairy Industry fed groups of cows on four levels of feeding. All groups received alfalfa hay and pasture in season. In addition to this, one group received corn silage and a grain mixture at the rate of one pound of grain to about four pounds of milk. Another group received a supplement of barley at the rate of one pound to about six pounds of milk. Still another group received an addition of corn silage. The results from various levels of feeding are shown in Table 24.

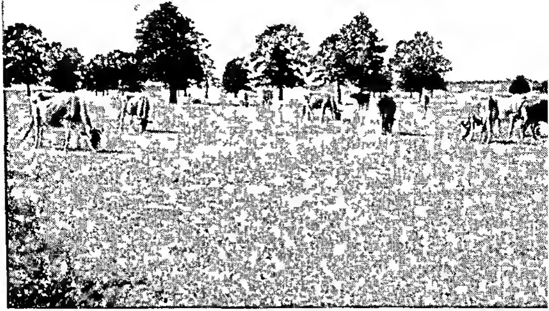
TABLE 24—MILK AND BUTTERFAT PRODUCTION OF VARIOUS LEVELS OF FEEDING

	Milk		Fat	
	lbs.	% of full grain ration	lbs.	% of full grain ration
Alfalfa hay—pasture Corn silage—full grain	12,886	100	434	100
Alfalfa hay—pasture	8,938	69.4	285	65.8
Alfalfa hay—pasture Limited barley	11,036	86.0	348	80.2
Alfalfa hay—pasture Corn silage	9,451	73.6	303	69.9

From U. S. D. A. Tech. Bul. 724.

Home Produced Feed:—A majority of feed nutrients needed by the cow can come from farm grown roughages. Likewise, most of the ingredients of a grain mixture may be produced on the home farm. Thus only a small percent of the total feed need be purchased when the cropping system furnishes the needed feeds.

Amounts to Feed:—Dairy cows should always be fed as individuals and according to production. Brief



Courtesy Ext. Ser U. S. D. A.

Fig. 78. Grazing in a Texas Pasture. A pasture should provide much of the required feed for a dairy cow. The scattered trees in the above pasture furnish ample shade to protect cows from intense mid-day heat

general rules for amounts of feeds to feed to dairy cows are listed in Tables 25 and 26.

Feed one pound of hay and three pounds of silage for each 100 pounds of liveweight of the cow. These two feeds may be interchanged on the basis of one pound of hay being approximately equivalent to three pounds of silage in feeding value. With green leafy hay and light grain feeding this rate may be increased from one-third to one-half.

With normal feeding of roughage, feed one pound of concentrate mixture to four pounds of milk for Holstein cows; and one pound of concentrates to three pounds of milk for Jersey or Guernsey cows.

A somewhat more accurate rule for feeding concentrates is given by Woodward of the United States Bureau of Dairy Industry. This is shown by Table 25. The basis for this recommendation is that with normal feeding of good roughage, the cow secures nutrients from the roughage to take care of maintenance and to produce some milk. This rule will better meet the needs of the high producer.

TABLE 25—RULES FOR FEEDING CONCENTRATES TO COWS

(By Woodward—U. S. Bureau of Dairy Industry)

Breed	Pounds milk to produce before concentrates are fed	Pounds concentrates to feed for each pound milk above designated amount
Jersey	10	.6
Guernsey	12	.55
Ayrshire or Brown Swiss	14	.45
Holstein	16	.4

Courtesy U. S. D. A.

Fig. 79. Supplementary Feed. This farmer supplements grazing with generous portions of feed to keep his dairy cows at peak production throughout the season.

A more convenient table for amounts of concentrates has been prepared by Morrison. This table has the added advantage of giving the amounts to feed with very liberal feeding of good roughage and with scant feeding or poor roughage feeding.

TABLE 26—GRAIN FEEDING TABLE FOR MILKING COW

Hay equivalent consumed per 100 pounds of live weight daily			Percentage of fat in milk						
2½ pounds very liberal feeding of good roughage	2 pounds usual rate of feeding good hay or good hay and silage	1½ pounds feeding scanty amount of good roughage or feeding poor roughage	3 0	3 5	4 0	4 5	5 0	5 5	6 0
Milk produced daily pounds			Total pounds of grain or concentrates to feed						
Pounds	Pounds	Pounds	lbs	lbs	lbs	lbs	lbs	lbs	lbs
17	10					1 0	2 2	8 1	3 5
19	12				1 6	2 8	3 2	4 2	4 5
21	14		1 5	2 0	2 4	3 8	4 2	6 3	6 7
23	16	9	2 3	2 8	3 8	4 7	5 2	6 3	5 8
25	18	11	3 0	3 6	4 2	5 5	5 2	7 4	8 0
27	20	13	3 7	4 4	5 0	5 5	7 2	8 4	9 1
29	22	15	4 5	6 2	5 9	7 5	8 2	9 5	10 2
31	24	17	5 2	6 0	5 8	8 4	9 2	10 5	11 3
33	26	19	6 0	6 8	7 5	9 8	10 2	11 8	12 5
35	28	21	5 7	7 5	8 5	10 3	11 2	12 7	13 6
87	30	23	7 4	8 4	9 3	11 2	12 2	18 7	14 7
89	82	25	8 2	9 2	10 2	12 1	13 2	14 8	15 8
41	34	27	8 0	10 0	11 1	13 1	14 2	15 8	17 0
43	86	29	9 5	10 8	11 9	14 0	15 1	18 9	18 1
45	88	31	10 4	11 6	12 8	14 9	15 1	18 0	19 2
47	40	33	11 1	12 4	18 7	15 9	17 1	19 0	20 8
49	42	35	11 8	13 2	14 5	16 8	18 1	20 1	21 5
51	44	37	12 6	14 0	15 4	17 7	19 1	21 1	22 6
53	45	39	13 3	14 8	15 8	18 7	20 1	22 2	23 7
55	48	41	14 1	15 6	17 1	19 5	21 1	23 3	–
57	50	43	14 8	15 4	18 0	20 5	22 1		
59	52	45	15 5	17 2	18 9	21 4	23 1		
61	54	47	16 3	18 0	19 7	22 4			
63	56	49	17 0	18 8	20 6	23 3			
65	58	51	17 7	19 6	21 4	24 2			
67	60	63	18 6	20 4	22 3	Regardless of the amount of grain theoretically required by a cow, she should not be fed more than she can handle safely			
69	62	65	19 2	21 2	23 2				
71	64	67	19 9	22 0	24 0				
73	66	69	20 7	22 8	24 9				
75	68	61	21 4	23 6	25 8				

Taken by special permission of the Morrison Publishing Company, Ithaca, New York, from *Feeds and Feeding*, 20th edition, by F B Morrison

Protein:—Since protein is the most expensive part of the feed, the protein content of roughages and of grains should be carefully checked. When an abundance of protein is furnished the cow from lush pasture, legume hay or legume silage the amount in the grain mixture may be low. However, when low grade rough-

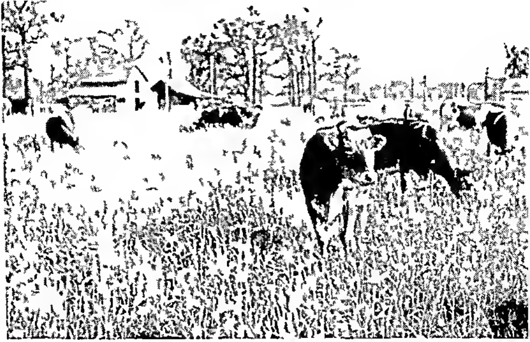
ages, low in protein, are used the grain mixture will need to contain a high percent of protein.

With good pasture or with legume roughages as the sole roughage, a grain mixture containing from 10 to 11 percent of digestible protein is sufficient. When about half of the roughage is legume, a grain mixture containing from 12 to 14 percent of digestible protein will be needed. If lower grade roughages are fed and a smaller proportion of it is legume, the amount of protein in the grain supplement will need to be increased.

Grain Mixture:—The feeding of a grain mixture to cows on pasture is usually profitable if the cows are heavy producers and the price of milk is high. Average producing cows should secure sufficient feed from good pasture to take care of their needs. The grain supplement should be given to the higher producers and in proportion to the amount of milk that they produce. The amounts may be fed in about the same ratio as that fed to cows which are fed very liberally on high quality roughages.

Supplement Feeding:—When pastures are short and dry, as is often the case with permanent pastures in August and September in some parts of the South, some supplemental feeding other than grain is most profitable. This may be furnished by supplemental pastures, soiling crops, hay or a summer silo. The supplementary pasture is most satisfactory. Legume hay fed at these periods will maintain the milk flow.

Soiling crops, which may consist of any green feeds cut and fed daily, are efficient in maintaining the milk yield. The disadvantage of these crops is that they have to be harvested daily, whether wet or dry weather, which means a great deal of hand labor. Corn silage, if surplus from winter feeding is available, or grass



Courtesy N C State College Ext. Ser

Fig 80 Grazing Herd This picture shows a well bred and well nourished herd grazing on an abundant growth of milk producing feed Succulent feed may be provided in most parts of the South in late fall and early spring by temporary pastures planted to small grain

silage made from surplus spring grass or grains, are splendid supplements for short pasture The grass silage put up in the spring and used in this way allows for double use of the same silo

TABLE 27—COMPARATIVE EFFICIENCY OF SILAGE AND GREEN SOILAGE CROPS FOR MILK PRODUCTION

Succulence Used	Total Feed			Production	
	Grain	Pasture	Succulence	Milk	Fat
	Pounds	Cow Days	Pounds	Pounds	Pounds
Silage	16 115	1914	56 904	40 477	1654
Green Soilage	16 487	1914	99 710	40 949	1678

From Iowa Exp Station Bul 201

Calculating Composition of Grain Mixtures

Determining the percent of protein and other nutrients in a grain mixture is accomplished by simple calculations The amounts of each ingredient and the composition of them are used Table 28 illustrates a method of calculation By using the designated amounts of these ingredients one may find the total pounds of

TABLE 28—METHOD OF CALCULATING COMPOSITION OF GRAIN MIXTURE

Ingredient	Lbs. Used	Total Protein		Digestible Protein		T.D.N.	
		%	lbs.	%	lbs.	%	lbs.
Corn	300	9.4	28.2	7.1	21.3	80.6	241.8
Oats	300	12.0	36.0	9.4	28.2	71.5	214.5
Wheat Bran	230	15.8	36.3	13.1	30.1	70.2	161.5
Cottonseed Meal	150	41.9	62.8	33.9	50.8	73.6	110.4
Salt	10	...	—	—	—	—	—
Steamed bone meal	10	—	—	—	—	—	—
Total	1000	16.33	163.3	13.04	130.4	72.82	728.2

protein, of digestible protein, and of total digestible nutrients furnished. Then by totaling the various nutrients furnished and dividing by the total pounds in the mixture, the percent of each is found.

If a mixture containing less protein is needed, the amount of the high protein ingredient, in this case cottonseed meal, can be reduced and one of the other feeds increased as indicated in Table 29.

TABLE 29—CALCULATING COMPOSITION OF GRAIN MIXTURE (Cont.)

Ingredient	Lbs. Used	Total Protein		Digestible Protein		T.D.N.	
		%	lbs.	%	lbs.	%	lbs.
Corn	350	9.4	32.9	7.1	24.8	80.6	282.1
Oats	300	12.0	36.0	9.4	28.2	71.5	214.5
Wheat Bran	230	15.8	36.3	13.1	30.1	70.2	161.5
Cottonseed meal	100	41.9	41.9	33.9	33.9	73.6	73.6
Salt	10	—	—	—	—	—	—
Steamed bone meal	10	—	—	—	—	—	—
Total	1000	14.71	147.1	11.70	117.0	73.17	731.7

Combinations of Feeds:—Various combinations of feeds will give good results. No one mixture has all the combined good qualities to the exclusion of all other mixtures. Simple mixtures, composed largely of farm grains, will give satisfactory results, when fed with roughages containing legumes. The kind of roughage being fed, the concentrates on hand, and the availability

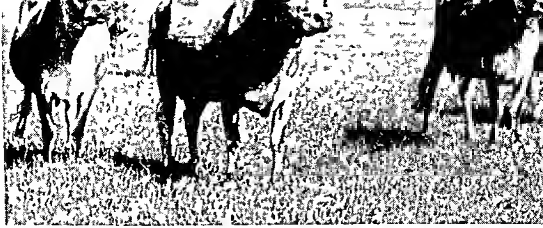


Fig. 81. Good Pasture Growth. Nutritious grasses and legumes in pastures provide many essential feed elements to dairy cows. The cows, above, have been produced through the use of the latest breeding and nutritional techniques.

and cost of other concentrates should be considered in determining the formula best suited to the specific condition.

Below are listed some simple formulas for feed mixtures and their approximate content of digestible protein and total digestible nutrients.

I. Mixture

ground barley	930 pounds
ground oats	650 pounds
wheat bran	400 pounds
salt	20 pounds
Digestible protein	10.0%
Total digestible nutrients	73.9%

II. Mixture

corn and cob meal	800 pounds
ground barley	580 pounds
wheat bran	500 pounds
cottonseed meal	100 pounds
salt	20 pounds
Digestible protein	10.1%
Total digestible nutrients	74.4%

III. Mixture

ground corn	600 pounds
ground oats	330 pounds
wheat bran	250 pounds
corn distiller's grains	600 pounds
soybean oil meal	200 pounds
salt	20 pounds
Digestible protein	15.8%
Total digestible nutrients	78.5%

IV. Mixture

ground corn	780 pounds
ground oats	500 pounds
wheat bran	400 pounds
peanut oil meal	300 pounds
salt	20 pounds
Digestible protein	13.5%
Total digestible nutrients	75.5%

These formulas are given as examples of some that are suitable for home mixing. Many other feeds may be used as well as various combinations of the same

feeds. If available a larger number of ingredients will give more variety, but are not essential, especially when concentrates are fed in connection with good hay or good hay and silage.

Raising and Feeding Calves

Most successful dairymen raise their calves for herd replacements. If a proved sire or one backed by satisfactory production records is used there is usually more opportunity for improving the herd by raising

Courtesy Ext. Ser. U. S. D. A.

Fig. 82. Calf with Dam. A calf is generally left with its dam until the third day. This is essential in order for the calf to get some of the first milk the cow gives after calving. Some dairymen raise calves with nurse cows. A good nurse cow will accommodate two to four calves.

herd replacements than by buying cows or heifers. There is also less danger from disease where they are raised at home.

The average life of dairy cows is about seven and one-half years. If the average age of heifers when they freshen for the first time is near two and one-half years, then cows are in the producing herd for an average of five years. This means there is a replacement of twenty percent of the herd each year. To take care of this replacement, three heifer calves will need to be saved per year for each ten cows in the milking herd. This number is sufficient to allow for some loss of calves from disease or accidents, and also the culling of some at first calving if they are not satisfactory.

The calf is generally left with its dam until the third day. It is essential for the calf to receive some of the first milk that the cow gives after calving. This is called colostrum and has properties which aid the calf in getting started off well. Colostrom contains a high percentage of albumin and minerals. It is also laxative and contains some protective substances which help the calf to resist certain disease infections. The cow will not fret for her calf as much if it is taken away early as she will if it nurses for several days. Also, it is easier to teach the calf to drink milk from a pail if taken away from the cow on the second or third day.

Feeding Milk to Calves:—For several days it is best to feed the calf milk from its own dam. It is easy to teach most calves to drink milk from a pail. This may be done as follows: (1) have a clean sterile pail, get fresh milk direct from the calf's dam and feed while warm; (2) lower its head into the pail of milk; (3) allow the calf to suck the feeder's fingers until it gets a taste of milk—then it will usually begin to drink. Some

dairymen use a nipple pail which allows the calf to suck the milk from the pail.

Amount to Feed:—The amount of milk to feed is important. Probably more digestive trouble arises from overfeeding than from underfeeding. A good rule to follow is to give the calf daily one pound of milk for each ten pounds of body weight. This amount should be divided into two or three feedings. At this rate a Jersey or Guernsey calf, to start with, would get about six or seven pounds (about six pints) and a Holstein calf nine or ten pounds of milk per day.

Courtesy U. S. D. A.

Fig. 83. Calves Should Be Properly Fed. To grow out thrifty calves like the ones shown in this picture requires proper feeding and care. It is essential for a calf to receive some of the first milk that the cow gives after calving.

Separate Calves:—Individual calf pens are recommended, but where they are not available, some kind of tie should hold the calf for several minutes after it has been fed milk. This tie may be a steel or home-made wooden stanchion or a neck strap. The sucking of each other is a bad practice, which may develop disfigured ears, chewed off switches, or injured udders. After the calf begins to eat grain it will not be as persistent in sucking.

Precautions:—Certain precautions in feeding milk will lessen the possibility of digestive troubles. The milk should be fed fresh each time so that the temperature will be the same and near blood heat. It is essential that the pails for feeding milk be kept clean. They should be cleaned and sterilized in the same manner as milk utensils. At the age of one week to ten days, the calf will begin to eat some grain feed and soon afterwards will begin to nibble at hay. A good grade of mixed hay is desirable.

Skim Milk or Milk Substitute:—Calves may be fed whole milk until they are four to six months old. However, most dairymen change from whole milk feeding to either skim milk or a milk substitute at four to five weeks of age. Either of the latter two methods is much less expensive and will grow out good calves that will develop into as desirable cows as those fed whole milk. They will not usually show as much bloom as when fed on whole milk.

Nurse Cows:—Under some conditions it might be wise to use nurse cows. Two or more calves at a time may be fed by one nurse cow. Where calves are to be raised for veal, it is practically necessary to raise them on whole milk entirely in order to get fast growth and a good finish.

TABLE 30—DAIRY CALF FEEDING SCHEDULE

Age	Whole milk	Skim milk	Calf meal	Management	Grain	Roughage
1st and 2nd days	Mother's first milk	Same as for whole milk	Same as for whole milk	Leave calf with cow	None	None
3rd and 4th days	6 pts. (6 lbs.) in 3 feedings, depending on size of calf	Same as for whole milk	Same as for whole milk	Separate from cow and keep calf in clean, well-bedded pen. Feed fresh whole milk at body temperature. Use clean pail and scald after each feeding		
5th to 7th day	7 pts. (7 lbs.) in 3 feedings	Same as for whole milk	Same as for whole milk			
Second week	8 pts. (8 lbs.) in 3 feedings	Same as for whole milk	4 pts. whole milk and calf meal according to directions	Provide stanchions so that each calf is fed separately		
Third week	8 to 10 pts. (8-10 lbs.) 2 feedings daily	8 pts. whole milk and 1 pt. fresh skim milk added each day. Beginning with 15th day leave off ½ pt. whole milk each day	4 pts. whole milk; calf meal according to directions	Supply fresh drinking water at all times	As soon as calf drinks milk give a little grain in a feed box. A good mixture is: 30 lbs. cracked corn 30 lbs. crushed oats 30 lbs. wheat bran 10 lbs. linseed oil meal	At first give only a handful at a time of a mixture of clover and common grasses. Feed alfalfa hay after fourth month

DAIRY CALF FEEDING SCHEDULE

Age	Whole milk	Skim milk	Calf meal	Management	Grain	Roughage
Fourth week	10 to 12 pts (10 12 lbs) 2 feedings daily		4 pts whole milk calf meal according to directions	Dehorn calves at 2 or 3 weeks when buttons set by the use of caustic potash		Continue feeding good quality grass hay
Fifth week	11 to 14 pts (11 14 lbs) 2 feedings daily	Feed 14 to 16 pte fresh skim milk in 2 feedings daily		Keep salt before calves		
Sixth week	12 to 16 pts (12 16 lbs) 2 feedings daily	Gradually increase skim milk until calf is drinking daily 1 lb (1 pt.) of skim milk for each 10 lbs of live weight	Feed according to directions of manufactuerer	A small lot protected from cold winds in the winter is desirable for exercise	Feed twice daily all calf will eat up in 30 minutes	Feed clean hay so it will not become soiled Put in a fresh supply each day of a good quality hay
7th to 10th week	Gradually increase quantity of whole milk until calf is drinking 1 lb (1 pt.) of whole milk for each 10 lbs of live weight					At 2 months of age start feeding silage gradually
10th week until weaned	From this age feed as specified under the method of feeding, and wean calves at the following ages			Separate bull calves from heifers when 5 or 6 months of age to avoid accidental breeding	At 6 months of age feed 2 or 3 lbs of a growing grain mixture as suggested	Keep good mixed hay in hay rack Do not turn calves on pasture until after 6 months of age
	Wean at 5 to 6 months of age	Wean at 5 to 6 months of age	According to directions			

From Va Polytechnic Institute Extension Bul 113

Changing to Skim Milk:—The changing from whole milk to skim milk can be made with large, strong calves at four weeks of age, but with smaller and less thrifty calves the change should be a week or so later. This change should be made gradually by substituting a small amount of the skim milk at a time over a period of one week. At the end of the time the calf should be entirely on skim milk.

The skim milk contains the high quality protein and minerals necessary for the calf.

Vitamins:—The fat which has been removed from skim milk contains a great deal of energy and all of the vitamins A and D of the milk. A grain mixture and a good grade of hay will furnish the needed energy and vitamins A and D. If suitable hay is not fed, the calf should receive some vitamin supplements. They may be supplied as codliver oil which furnishes both vitamins A and D. Vitamin A may be given in the form of a carotene concentrate.

Grain Mixture:—A grain mixture to be fed as a supplement to milk can be made from 30 pounds cracked corn, 30 pounds crushed oats, 30 pounds wheat bran, and 10 pounds of linseed meal. At one month old the calf should be eating one pound of grain a day. This should be increased to three or four pounds a day by the time milk is discontinued. Clean, fresh hay should be given the calf daily. Sometimes leafy legume hay fed with liberal milk feeding is too laxative. If this occurs, a change to a good grade of mixed hay should correct it.

Dry-Fed Calf Mixture:—There has been developed a large number of milk substitutes. They are ordinarily used to replace whole milk feeding entirely at four or five weeks of age. The dry-fed calf mixture given below was developed at the New Jersey Experiment

Station. The Station recommends that it be fed dry. The calf should be given some by the time it is two weeks old. It should also be given access to alfalfa hay. The mixture should be gradually increased until the calf is consuming approximately one pound daily when 30 days old and up to four or five pounds at five months. This feed can be replaced with other mixtures when a calf reaches six months of age.

The New Jersey Dry-fed Calf Mixture

100 pounds	yellow corn meal
150 pounds	ground oats
50 pounds	wheat bran
50 pounds	linseed meal
50 pounds	soluable blood flour
4 pounds	finely pulverized steamed bone meal
4 pounds	finely pulverized limestone
4 pounds	salt.

Feeding Calves After the Milk Feeding Period

The time at which milk feeding is stopped is a critical period for the calf's growth, unless it is given suitable feeds. Too often when milk feeding ceases the calf is changed directly and entirely to pasture or roughage feeding. Calves that arrive at this period during the winter or barn feeding period can be kept growing normally by feeding two to four pounds of a suitable grain mixture along with hay and with silage if it is available. This mixture may be the same as that fed along with milk. If a calf is taken off milk during the pasture period, it will need some grain to supplement the grass. From one to two pounds of a mixture of farm grains is a satisfactory supplement.

Heifers from 12 months of age until two months before calving will not need any supplement feeding if they have free access to a good pasture. During the winter, the need for grain feeding depends on the kind

Courtesy Ext. Ser. U. S. D. A.

Fig. 84. Heifers on Pasture. Heifers, such as the ones shown in this picture, should be properly fed so that they will be in good condition for freshening. Liberal amounts of roughage and a grain mixture with medium protein content is sufficient. The roughage may be obtained from the pasture.

and amount of roughage they receive. With corn or cane silage and grass hay, heifers need some protein supplement. However, if good legume hay and corn silage are fed liberally, normal growth will be made without grain feeding. Grass or legume silage alone will furnish all their needs but they will consume some more feed if given dry roughage in addition. A heifer cannot consume enough corn silage to secure sufficient protein.

Feeding Dry Cows and Springing Heifers

Dairymen usually plan to have their cows calve once every twelve months, but on the average the calving intervals extend longer than this. For a cow to do her best, she must have a rest period of six to eight weeks.

The care and feeding of the cows during the dry period and of the heifers before calving gives the dairyman an opportunity to get his animals in good condi-

tion for freshening. During this time, they can build up body reserves of fat and minerals. A heavy producing cow or heifer cannot consume and digest sufficient feed to furnish all the nutrients needed for maintenance and for milk production for a few months after calving. To maintain this high level of production, the cow draws on her reserves. For this reason a cow that is put in high condition during the dry period will produce more milk and fat during the next lactation period.

The dry cow and close springing heifer should not be turned out with wintering heifers and be expected to get into condition for freshening. With liberal roughage feeding, a grain mixture with medium protein content is sufficient. A dry mixture that is desirable and used a great deal consists of:

ground corn or barley	300 pounds
ground oats	300 pounds
wheat bran	300 pounds
linseed meal or soybean oil meal	100 pounds
steamed bone meal	10 pounds
salt	10 pounds
	1020 pounds

The above mixture can be used during the entire dry period. However, a special freshening ration may be used during the last four weeks which contains a greater variety of feeds and is lighter. The following is a formula for the special ration:

ground barley or corn	150 pounds
ground oats	200 pounds
wheat bran	200 pounds
linseed meal or soybean oil meal	100 pounds
alfalfa meal	150 pounds
beet pulp	100 pounds

molasses	100 pounds
steamed bone meal	10 pounds
salt	10 pounds
	1020 pounds

Feeding Bulls

Bull calves that are to be raised for herd sires should be well grown. The young bull, as well as an older one, needs space enough for exercise, and if possible access to a considerable supply of grazing. Where plenty of pasture is available the bull is more likely to secure the type of feeds that he needs including vitamins. He also gets exercise while on pasture. This will keep him in better breeding condition. The use of electric fences makes it much easier to fence a bull pasture. There may be a need for additional feeding, depending on the amount and quality of grazing available in the pasture. A good grade of hay, or a limited amount of silage and a good grade hay, should be fed when no pasture is available. Too heavy feeding of any roughage and especially silage has a tendency to make the bull paunchy and slows him up in breeding.

In addition to roughage the bull needs sufficient grain to keep him in good breeding condition. This does not mean that the bull should be kept fat.

A desirable grain mixture for bulls is the one previously suggested for dry cows.

Preparation of Feeds

All grains should be ground or crushed for dairy cattle, except for calves under six months of age. These young calves may have their grains cracked or coarsely ground. They do quite a good job of chewing their feed as they consume it but older cattle do not. In the case of cattle after the milk feeding period, relatively little chewing is done at time of eating. The grains are

heavy and are not regurgitated for remasticating later as roughages are. A great deal of unground grains pass through cattle undigested. Any feed is more desirable and more thoroughly digested when ground to a medium fineness rather than when ground extremely fine.

The chopping of roughages is seldom profitable. Cows are equipped with good grinders and the main advantage in chopping is to make the animals eat up cleaner the coarser parts of the feed that they usually refuse. These coarse parts are the least palatable and are the least nutritious part of the feed. The expense involved in chopping is usually as great as the added value.

In cases where roughages are scarce and high in price, it may be profitable to chop coarse roughages that will not be cleaned up well if fed long. There is less refusal of corn stover, that is fed in the barn, when chopped. The chopped stover which is left makes good bedding and is easy to handle when the manure is removed, whereas the uncut stalks are very hard to remove. The grinding of roughage is not recommended except when it is to be used in the grain mixture. In such cases, it must be remembered that the ground roughage is still a roughage and not a concentrate in composition.

SUGGESTIONS FOR STUDY

A. Questions and Problems

1. Give the rule for normal feeding of hay and silage to dairy cows.
2. List two rules for the amount of concentrate feed to feed dairy cows.
3. At what rate would you feed milk to calves?

4. Why not feed a bnll all the silage and hay that he will eat?
5. Why are legume hays of higher feeding value than grass hays?
6. How can you determine the quality of hay?
7. Why is it necessary to grind grains for cows and not for calves?
8. Prepare a formula for a grain mixture as follows:
   a. use five ingredients,
   b. have 40 percent of the feeds bulky feeds,
   c. to contain 13 percent to 14 percent digestible protein, and
   d. include one percent salt.

B. Activities

1. Take a herd of dairy cows, preferably your home herd or a neighbor's, and calculate the needed feed for one year. First, determine the amount of hay and silage that will be needed, also, the acres of pasture. Then calculate a grain mixture for winter feeding for cows, one for summer feeding for cows, one for bulls, one for yearling heifers, and one for calves being fed skim milk. From the general rules for feeding, calculate the amount of each mixture needed.

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CHAPTER XII

PASTURES FOR DAIRY CATTLE

Pasture grasses and legumes are the natural feeds for cattle. They furnish nutrients in the very best form and are rich in vitamin content. Young grasses and clovers are high in protein and they furnish a great stimulus to milk production. More milk is produced during the early pasture season than at any other time. The yellow color of milk is greater at this time than at any other.

With the knowledge of the great milk producing ability of lush pasture grasses and legumes, dairymen attempt to supply winter feed in a form that is as similar as possible to that of the natural pasture. Green feeds are cut and ensiled. Green hay crops are cured in ways that will retain as much as possible of the leaves and the green color.

Pastures Cheap Source of Feed:—Pastures are of great economic importance since they furnish feed cheaper than any other source of nutrients. The cow harvests the feed herself, therefore, there is no labor cost in harvesting and storiug it. The feed from pastures is utilized without damage of poor curing or improper storage.

While there is great economic value in the use of pastures as a source of feed, there is also the advantage of maintaining soil fertility and preventing erosion. This is one of the main features of a soil conservation program. The use of fewer cultivated crops and the use of more sod formiug forage crops is the basis for the preservation of much of the lands of the South.

Courtesy N C State College Ext. Ser

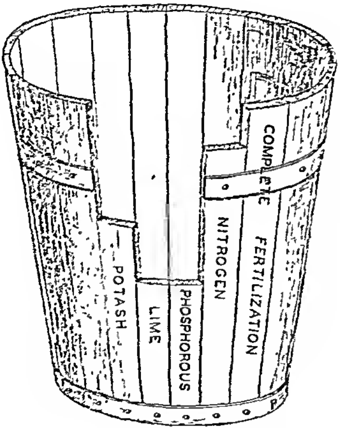
Fig. 85 Palatable Feed. The proper seeding and fertilizing of grass and legume mixtures in pastures insure abundant growth of palatable feed which makes modern dairying more profitable.

Fertilization and Improvement Necessary:—Some areas in the South are natural grass lands, however, a large percentage of the soil requires some fertilization and improvement to produce desirable pastures. There is much acreage classed as pasture which supplies little or no feed. Pastures should receive as much care and plant food feeding as similar lands used for other crops. The solution to more milk production in the South is the greater use of improved pastures.

In recent years the Agricultural Adjustment Administration has done much to encourage pasture improvement and development in the South. Rather liberal financial assistance has been given by this Federal Agency for several types of practices designed to encourage the improvement of pastures Farmers have received aid for such practices as cleaning up undergrowth, seeding, liming, fertilizing, reseeding depleted spots, mowing, and terracing. Approximately 70%

of the cost of carrying out these practices was obtained in the form of A.A.A. assistance.

South Has Long Pasture Season:—The long growing season in the South makes it possible to lessen the barn feeding period which reduces the feed cost of milk production. Some sections furnish pasture practically the entire year, if supplementary pasture crops are grown.



Courtesy Va. Exp. Sta.

Fig. 86. To Develop Good Pasture. Build up the short staves by economical use of fertilizers and you will have barrels of pasture.

In some milk production experiments in Tennessee, the grazing of cows practically every day of the year, supplemented with roughages and limited grain feeding, was compared with summer grazing and winter feeding on roughage and full grain feeding. Almost as much milk and fat were produced on the limited grain and all-year pasture as on the full grain feeding. This is shown by Table 31.

Fertilizers Increase Pasture Yields:—The application of fertilizers to permanent pastures is probably the quickest method to increase the feed produced and

TABLE 31—COMPARISON OF PRODUCTION

Group	Feed				Production	
	Concentrates lbs	Hay lbs	Silage lbs	Pasture days	Milk	Fat
Full grain	1 836	3 348	4 983	198	6,442	376
Limited grain	974	2,794	4 328	346	6 265	367

From Tennessee Exp Sta Bul 163
NOTE The pasture crops used were bluegrass hop clover, lespedeza white clover barley and rye

Courtesy Ext. Ser U S D A.

Fig. 87. Holstein Herd on Permanent Pasture. This is the third year for this pasture planted to blue grass, timothy, and White Dutch clover, Kent County, Maryland

to secure a more complete covering of the land with desirable plants of grasses and legumes.

At tbe Virginia Station, pasture experiments with dairy cattle showed an increase in the production of feed nutrients of from 43 percent to 60 percent for fertilized bluegrass pastures over unfertilized pastures. These results were the average for a five year period. Calculating the results of these experiments according to the number of pasture days each acre furnished per year, increases of 46 percent to 80 percent were secured by fertilization. The resnlts are shown by Table 32.

TABLE 32—PRODUCTION OF PASTURE ON FERTILIZED AND UNFERTILIZED BLUEGRASS

Kind and amount of fertilizer	1 ton limestone ½ ton 0-6-0	1 ton limestone ½ ton 5-5-0	1 ton limestone ½ ton 0-5-5	Check plot no fertilizer
Pounds of T.D.N. produced per acre per year (average 5 years)	1966 2	2201.3	2200.2	1371.2
No. of cow days (1000 lb.) grazing per acre per year	116 3	142 5	132.8	78.9
Acres required per cow	1.5	1 2	1.3	2.2

From Exp. Va. Station Bul. 309.

Permanent Pastures

The permanent pasture grasses and legumes vary from one section to another, even from one part of a state to another. For tbis reason no one mixture can be given for all tbe Sonthern States. Neither would it be practical to list the most desirable mixtures for the individual areas. The various experiment stations have developed the most snitable mixtures for tbe varions soil types in their respective states, and have this information available for farmers.

Pastnre Grasses:—There are a number of grasses that are suitable and valuable for pasture use in the South. Some of these are discussed briefly below.

Courtesy J A. Arey, N C State College Ext. Dairyman

Fig. 88. Grazing Herd. A pasture filled with palatable grasses and legumes is a reliable and cheap source of most of the essential feed elements.

Kentucky Bluegrass:—Kentucky bluegrass is the most extensively used pasture grass in the areas where it will grow abundantly. In the natural bluegrass section it will come in itself if conditions are favorable. It furnishes abundant grazing in spring and early summer, produces very little in late summer, but comes back in the fall to furnish good grazing. Canada bluegrass may be grown in about the same areas as Kentucky bluegrass.

Orchard Grass:—Orchard grass furnishes considerable pasturage, but is not as good a pasture grass as bluegrass. It is bunchy and does not form as even a sod as bluegrass. It is a very early grass but it is not as palatable as some other grasses.

Timothy:—Timothy may be used in mixtures, and provides good pasture quickly. It can be used for grazing while other grasses in the mixture are getting a good set.

Carpet Grass:—Carpet grass is a good sod forming grass, and is suitable for moist sandy soils. Its yield is only fair and it is not as rich in nutrients as many other grasses. It will, however, stand heavy grazing.

Bermuda:—Bermuda grass is well adapted to the Piedmont Section of the South and is a persistent

grower. It is not killed by cultivation. It starts late but furnishes good grazing throughout the summer.

Dallis Grass:—Dallis grass is used for pasture, but not as extensively as carpet grass, Bermuda, or bluegrass. It is a deirable and productive pasture grass.

Redtop:—Redtop is used in a large percentage of pasture mixes for poorer soils, where it is more easily established than most other grasses.

Rye Grasses:—Perennial rye grass and Italian rye grass are being used in many sections in pasture mixtures. Either one is easy to get started and furnishes a large amount of grazing the first year while other grasses are getting well started. They are short lived, the perennial being more persistent than the Italian.

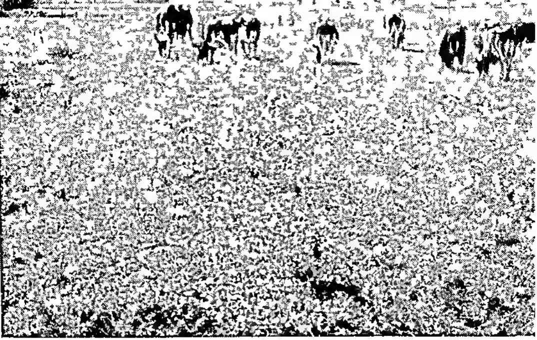
Legumes for Pastures:—Legumes are used to a great extent in pasture mixtures. Some are used alone. Mixtures of grasses and legumes usually produce more grazing than either alone. Some of the legumes suitable for pasture are discussed briefly in the paragraphs that follow.

White or Dutch Clover:—White or Dutch clover is the most universal clover found in pastures. While it is persistent its growth varies greatly from year to year. It is usually prevalent in bluegrass pastures that have had applications of lime and phosphate.

Alsike Clover:—Alsike clover may be used in pasture mixtures if the soil is not acid. It will give good grazing, but does not usually last more than two years.

Bur Clover:—Bur clover is used in the South in mixtures with Dallis grass and Bermuda grass. It supplements their growing period.

Hop Clover:—Hop clover is a small, early growing plant that supplements most of the grasses and lespedeza. The growth is usually complete by early summer. It resembles lespedeza in the early growth. A yellow blossom is produced as the plant matures.



Courtesy Ext. Ser. U. S D. A.

Fig. 89. A Terraced Pasture. This pasture seeded to Korean lespedeza and Dallis grass is located in Oklahoma. It has been terraced to conserve moisture and to prevent erosion.

Ladino Clover:—Ladino Clover is a medium sized clover with a white blossom. In some sections Ladino is supplying more feed per acre than any other crop. It ranks as a pasture crop the same as alfalfa ranks at the top for a milk producing hay. Ladino is usually seeded with orchard grass, timothy, fescue or some other grass. It can not be grazed too close or the stand will be injured. Grazing alternate fields is generally practiced. Precautions must be taken to prevent bloat.

Lespedeza:—Lespedeza is found in all parts of the South. In many areas Japanese or common lespedeza comes in the pastures naturally. Three improved varieties, Kobe, Korean and Tennessee 76, are larger than the common and yield more forage. All are annuals, but will reseed themselves under most pasture conditions. They are late in getting started in the spring, but furnish good grazing throughout the summer and fall.

Alfalfa:—Alfalfa is used to some extent for grazing. It supplies abundant pasturage, but the stand may be injured if grazed heavily. Cattle must be watched while on alfalfa because of the danger of bloat.

Courtesy Ext. Ser. U. S. D. A.

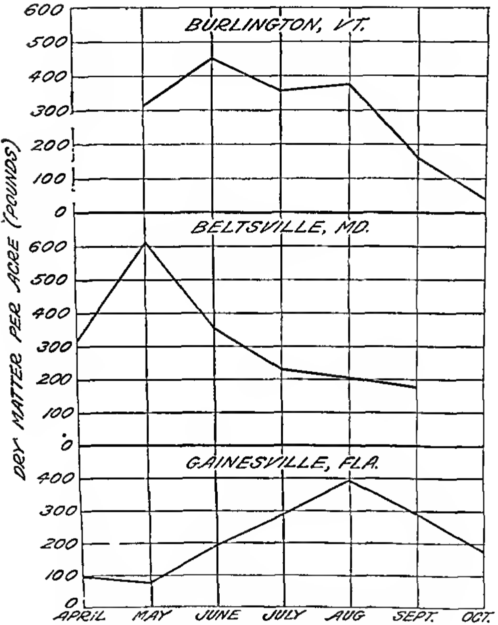
Fig. 90. On Temporary Pasture. This herd in Laurens County, Georgia, is on a temporary pasture following oats that have been harvested.

Pasture Mixture:—A mixture of several grasses and legumes that are adapted to the local section should be used. This information may be obtained from the nearest experiment station. The type of soil and the fertilization must be considered in the selection of the mixture. Many other pasture grasses and legumes besides those listed in this chapter are being used successfully in the South.

Supplementary Pastures

To obtain the greatest amount of feed from grazing, some supplementary pastures must be used. There are weak periods in permanent pastures. These periods vary in different states and with different grasses being used. In the upper South the short supply of pasture is in August and September, while in the more extreme southern area shortest growth is in the early summer. The variation in growth of permanent pasture in different months of the year and in different sections is shown graphically by Figure 91.

The dry matter production is listed by months on the basis of results from the Bureau of Plant Industry in Florida, the United States Bureau of Dairy Industry in Beltsville, Maryland, and the Vermont Experiment



From U. S. D. A. Misc. Publication 194

Fig. 91. Seasonal Yields of Permanent Pastures. The month when the peak of growth is reached varies in different sections of the country. Temporary pastures may be used during some of the time when permanent pastures do not furnish adequate grazing.

Station. It is noted that the peak of production is reached in May in Maryland, in June in Vermont and in August in Florida.

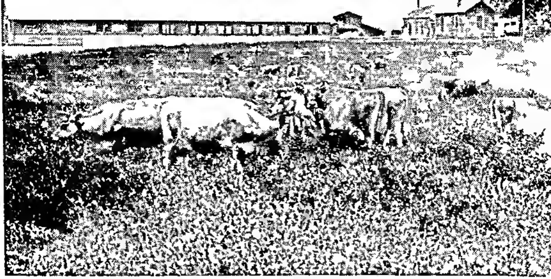
Figure 91 also indicates the periods of the year that the production is low and supplementary feeds are needed. By selecting crops that make their greatest growth at the time that the permanent pastures are not producing very much, grazing can be made available over a greater part of the year. Certain supplementary pasture crops are suitable for some areas and are not for others. The extreme South requires supplements at a different time of the year from that of the upper South. In more southern sections, a longer grazing period is possible.

Supplementary Pasture Crops:—Rye, oats, wheat and barley are all used for late fall and early spring grazing. These grain crops may be used entirely for grazing or they can be grazed in the late fall and early spring and then allowed to grow up and produce a grain crop.

They may be seeded separately or one or more used together. They are also used in combination with vetch, crimson clover, Italian rye grass and winter peas. When these winter grains are seeded early they will furnish considerable grazing in the late fall and probably some throughout the winter—depending on the latitude—and again in the spring before permanent pasture is available.

Italian rye grass is a quick growing grass which covers the ground well and is suited for fall and spring grazing. It is often seeded with crimson clover.

Crimson clover is valuable as a pasture crop for early spring and also as a soil builder. If not completely grazed the remaining crop may be used as a green manure crop. If seeded early some grazing is afforded



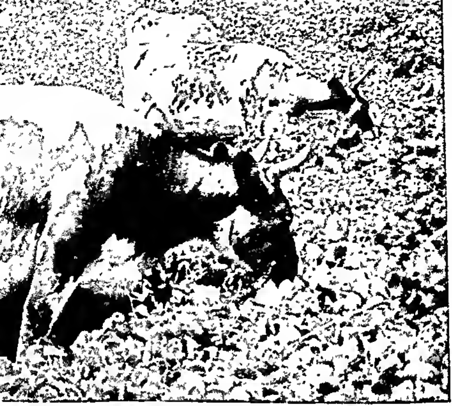
Courtesy N C. State College Ext. Service

Fig. 92. Crimson Clover Pasture. Shown here are dairy cattle on a field of crimson clover located in Monroe County, Georgia. It is being used as a supplementary pasture crop.

in the late fall. Crimson clover is commonly sown with rye grass, rye or other winter grains for pasture.

Sweet clover is used as a supplemental pasture. The crop lasts for two years. A great deal of grazing is supplied in the late summer of the first year, but the greatest amount is furnished the second year from early spring until the middle of the summer. Therefore, the most advantageous use of sweet clover can be made by having two fields and seeding one field each year. This seeding may be made in the spring on fall sown grain crops.

Sudan grass is a very popular midsummer grazing crop. It is seeded in the spring and is ready for grazing by the middle of the summer, or in four to six weeks. Sudan grass may follow rye, rye grass or crimson clover. If this is done supplementary feeds may be had from the same field over several months of the year. Occasionally, following a drought or frost, Sudan grass contains prussic acid which will poison cattle. If it is to be pastured under these conditions, a wise practice is to try out one cow or heifer that is not so valuable before the herd is turned on it. Also, animals should be well filled before they are placed on it the first time. In sections where permanent pastures are short from mid to



Courtesy N. C. State College Extension Service

Fig. 93. Kudzu Crop. Kudzu has favorable possibilities as a pasture crop and is gaining more popularity with dairymen. Cows, as shown above, seem to relish it. It is usually used for temporary or seasonal grazing. It will not stand continuous grazing.

late summer, Sudan grass can be used most profitably to maintain milk production at a time when it is very hard to keep cows from dropping off.

Kudzu, a legume, is used on some southern farms for supplementary grazing. This plant may be grown on steep hillsides to check or prevent erosion. In recent years thousands of acres of Kudzu have been planted in the South. It is used largely as a hay crop and to prevent erosion. Kudzu will not stand continuous grazing.

Lespedeza is an annual and is used in permanent pasture mixtures since it will reseed itself. It may, however, be used as a supplementary crop. Lespedeza

is often seeded with small grains, which may be grazed off or harvested for grain.

The use of some combination of these temporary crops not only keeps up milk production, but saves much of the expensive barn feeding.

The use of electric fences to divide fields for pasturing allows for more flexible use of land and crops.

Sometimes various green crops, including the ones listed above, and corn, soybeans and many others, are cut daily and fed to cows during periods of short pasture. This practice is more expensive than pasturing off the crops, because of the labor involved.

Production of Supplementary Pasture Crops:—The amount of pasture furnished by some supplementary pastures at the Virginia Experiment Station are given in Table 33.

TABLE 33—PRODUCTION OF SUPPLEMENTARY PASTURES
(Five Years' Average)

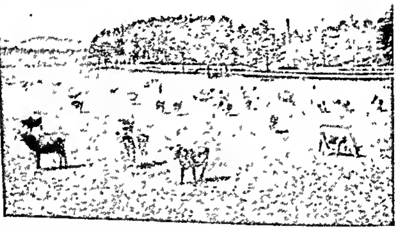
Pasture Cops	Sweet Clover	2 Year Rotation Rye and crimson clover followed by sweet clover and Lespedeza	Rye Grass and Crimson clover followed by Sudan grass
T D N. Production per acre (lbs)	1,455	1,035	1 261

Feed Cows Liberally:—To produce economically, dairy cows must be liberally fed. If pastures are succulent and plentiful it is easy for a cow to consume large quantities of feed from pastures. If grasses become mature and begin to head out they will not maintain production as well, but instead will tend to increase the weight of cattle.

Even on good pasture, a high producing cow needs some grain feeding in order that she may consume

sufficient nutrients to keep up her milk flow and remain in good condition. Once a cow drops down very much in her milk, she does not usually come back to that level of production during that lactation period. Rates of grain feeding and kinds of mixtures are discussed in Chapter XI.

Heifers on Pasture:—Dairy heifers over one year old will do well and grow to normal size on a good pasture without grain feeding, but calves under one year old require some grain feeding. Yearling heifers



Courtesy Biltmore Farms

Fig. 94. Good Pastures Essential. Well-developed pastures filled with the proper grass and legume mixtures lead to high milk production and better livestock. The pasture shown here appears to be a bit over-grazed. Continuous over-grazing will destroy a pasture sod.

can utilize less desirable grazing from pastures than can producing cows. In times when pastures are too short, they need some additional feed to develop into good size heifers at calving time.

Pastures Produce Cheap Feed:—Grass is our cheapest feed. The improvement of pastures not only pro-

duces more feed, but produces additional feed cheaper than the cost of feeds from other crops. The increase in the carrying capacity of pastures makes possible heavier grazing on fields located close to the dairy barns. The mild climate and long growing season of the South can be utilized to better care for dairy herds at lowered feed costs.

Courtesy Ext. Ser U. S. D. A.

Fig. 95 Electric Fence. Electric fences are being used more and more in the South.

SUGGESTIONS FOR STUDY

A. *Questions and Problems*

1. What is the length of the grazing season in your community?
2. What grasses and legumes are used locally for permanent pastures on your home pasture?
3. Which are used for supplementary pastures?

4. What pasture improvement projects are being carried on near you? On your home farm?

B. Activities

1. Secure recommendations from your Agricultural Experiment Station on the pasture crops best adapted to your section of the state; also the fertilizing practices recommended.
2. Find out for your locality which months a permanent pasture will not produce sufficient grazing.
3. What supplementary crops can be used on your home farm in connection with permanent pasture to give the longest grazing period.
4. Locate some pasture improvement demonstrations and visit them to study the methods used and the results that are being obtained.

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CHAPTER XIII

SILAGE FOR DAIRY CATTLE

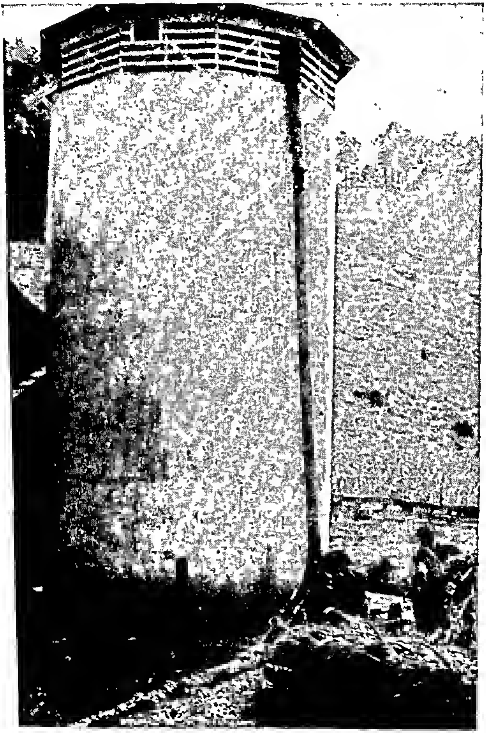
The use of silage for feeding dairy cattle is a universal practice. Silage is almost essential for economical feeding of dairy cows when they are not on pasture. The making of silage is the one means available for taking the green forage from the field with its natural juices and preserving it in a succulent form. All parts of the plant are preserved in highly palatable form. There is less loss of nutrients from feeds stored in the silo than from most means of curing crops in the field.

The space required to store feeds as silage is much less than for dry roughage. A ton of silage will require about 50 cubic feet of space, depending on the depth of the silage. Hay will require six to eight times as much space. A ton of hay furnishes approximately as much feeding value as three tons of silage. Feed stored as silage is not subject to fire hazards as is hay.

In addition to being succulent, silage furnishes feed nutrients as cheap or cheaper than any other form of farm feed, with the exception of that consumed from pastures. A silo can be used to advantage, if there are as many as ten dairy cows or their equivalent to be fed. It is necessary that sufficient removal be made daily to prevent spoilage. To do this a layer two inches thick must be removed daily during the winter and three inches during the summer months.

Kinds of Silos

Upright Silo:—This is the type that in the past has been most generally used. It is more convenient from which to feed, however, the initial investment is much



Courtesy Ext. Ser. U. S. D. A.

Fig. 96. Upright Silo. This upright 70-ton silo is being filled with corn. It is located in Haywood County, North Carolina. It is constructed of concrete.

greater than in the case of the pit or trench silo. Most kinds of upright silos are of quite durable construction.

Concrete silos are widely used. When made correctly from good quality materials, they are substantial silos. The monolithic, or solid concrete type, may be less expensive to construct if some of the materials are available nearby and if some farm labor can be used for building it. Reinforcement should be built into the concrete to insure sufficient strength. Special forms are necessary for the building of this kind of structure. Concrete silos are very durable, but are subject to the action of the silage acid on the inner surface. This action is called pitting and can be lessened by the use of linseed oil and coal tar dressing applied previous to or at the time of filling.

Concrete staves supported with hoops give an attractive silo and are very satisfactory. They have the advantage of being quite easy to add to later if additional height is needed to give more capacity. Some manufacturers of concrete staves prefer to sell the entire silo completed at the farm. There are some concrete staves on the market that are treated on the inside surface to render them more acid resistant.

Concrete blocks are used, usually without hoops but with reinforcement built in along with the mortar. The cost of either the staves or blocks depends a great deal on the distance they must be shipped and the transportation cost.

Tile silos are very durable and give splendid appearance. The tile is glazed and very resistant to acid. They are made to fit close to reduce the amount of exposed mortar. Reinforcement is built in during construction. The original cost is usually rather high.

Brick silos are being built more extensively than in previous years. They require reinforcement which can

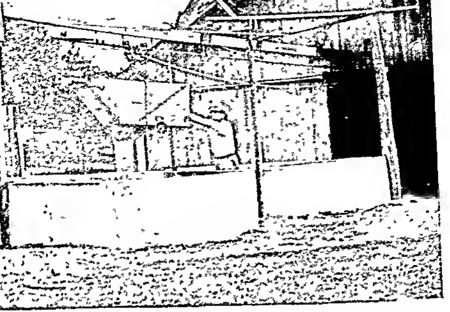
be built in with the mortar. Brick silos are more desirable when they are finished with a smooth coating of special cement plaster. The economy of brick in silo building depends on the availability and cost of brick locally.

Metal silos are on the market and some are being used. Results are varied from different users. The newer metals used are more acid resistant than some of the older ones. They need regular painting or dressing on the inside to keep them in the best condition. The metal silo can be taken down and removed, whereas most other types cannot be moved.

The wooden stave silo is one of the oldest types used. The durability depends on the material of which the staves are made. Cypress and fir are used extensively. Some of the other materials used are creosoted to extend the life of the material. Metal hoops are most universally used. Wooden hoops can be used but are not as satisfactory. The metal hoop should be tightened when the staves dry out and become loose. It may be necessary to loosen the hoops after filling when the staves swell from the moisture. This will prevent bursting. There are other types of home-made silos as well as modifications of the other types.

When grass silage is to be used more reinforcement is needed, as more pressure is developed than when used for corn silage. In a permanent structure it is wise to make it sufficiently strong to handle any feed that may be used.

Trench and Pit Silos:—Where the overhead expense must be kept to a minimum because of a small number of cows or a low priced milk market, pit silos or trench silos may be used instead of the upright structures. It is not as easy to remove the silage from these as from the upright silos.



Courtesy Ext. Ser. U. S. D. A.

Fig. 97. Pit Silos. They are more expensive to construct and it is more difficult to get the silage out of them than with the trench type. Note the cart and apparatus for conveying silage from the pit to the barn. There is some danger in descending into a pit silo on account of lack of oxygen. If a lighted lantern continues to burn when lowered into a silo, it is safe for a man to descend.

The pit silo is constructed below ground and is comparable in capacity to one of the same dimensions above ground. In some sections the soil conditions are not favorable to the pit storage. The pit may be walled with many kinds of masonry or other materials. These silos require less power for filling since the cut material does not have to be elevated. Silage keeps well in the pit type silo. There is less opportunity for air to penetrate the sides and cause spoilage, also, the silage will not freeze in cold weather.

In pit silos or in others that extend below ground. care should be exercised in entering the pit when it is partially filled with fresh silage. At times poisonous gases are formed from early fermentation and may accumulate in the pit; agitation of the air will remove it. When deep pits are used, hoists will make the removal of the silage easier.

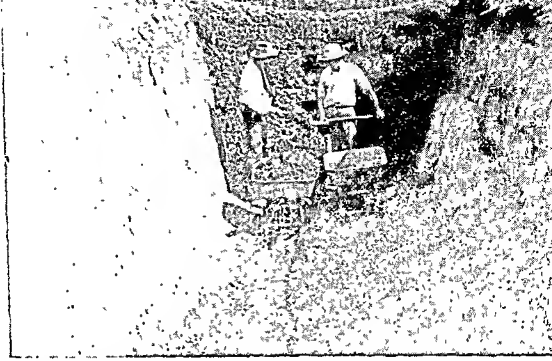


Fig. 98. Trench Silo. A trench silo showing good construction and covering. There is practically no waste of feed in such a trench silo. This type silo is becoming more and more popular in the South.

Table 34 gives the capacity of silos of different dimensions.

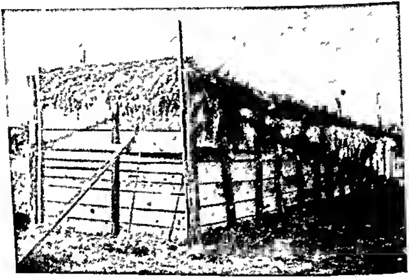
TABLE 34—CAPACITIES OF SILOS OF DIFFERENT SIZES
U.S.D.A. Farmers Bul. 1820.

Depth of silage (feet)	Capacity with an inside diameter of—										
	10 ft.	11 ft.	12 ft.	13 ft.	14 ft.	15 ft.	16 ft.	17 ft.	18 ft.	19 ft.	20 ft.
	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
20	27	...	...	...	...	...	...	...	...	...	...
22	30	37	...	...	...	...	...	...	...	...	...
24	34	41	49	...	...		...	...	...	...	...
26	38	46	55	65	...	.	...	...	...	...	...
28	43	52	61	72	81		...	...	...	...	...
30	47	57	68	80	92	106	121	...	...	...	...
32	51	62	74	87	100	115	131	148	...	...	...
34	56	67	80	94	109	125	142	161	180	...	...
36	...	73	86	101	117	135	153	173	194	216	...
38	...	...	93	109	126	145	165	186	209	233	258
40	...	...	100	117	135	155	177	200	224	219	276
42	...	...	...	124	144	165	188	212	237	264	293
44	...	...	...	...	152	174	198	224	251	279	310
46	...	...	...	...	...	184	209	236	265	295	327
48	...	...	...	...	...	...	220	248	279	310	344
50	...	...	...	...	...	...	...	261	293	326	361

NOTE: Figures in the above table are for corn silage; grass silage is heavier.

The trench silo has come into extensive use especially for small herds and in butterfat and manufacturing milk producing areas of the South. Silage may be preserved in trench silos with very little more loss than in upright silos if they are properly constructed

and filled and covered correctly. The trench silo is also used to hold over forages from good crop years to poor years, thus providing cheap insurance against possible feed shortage without the capital outlay of additional upright silos. Green grasses and other forage crops can be successfully preserved in trench silos.



Courtesy U. S. D. A.

Fig. 99. Over-ground Silo. This silo is walled with planks and lined with paper. It contains corn and sorghum silage. It is located on the Wilson Mann farm in Madison County, Alabama. This type silo is sometimes used in level, wet country.

The trench is preferably constructed on a medium grade. It should run up and down the slope. This is not essential but allows for easier drainage from the trench and for the removal of the silage. The trench should be dug with sloping sides, which should be reinforced or walled up to make it more durable. However, for one year's use it is satisfactory with the dirt sides if the land is well drained and not in too low a place.

When filled, the material should be covered with several inches of wet green material. This cover-

ing should then be wet down and finally covered with several inches of dirt.

The size of the silo must be in keeping with the amount of feed to be stored. The cut material will not pack in trench silos as tightly as in the high upright type. The packed silage in a trench silo weighs approximately 30 pounds to the cubic foot as compared to an average of about 40 pounds in a 30-foot upright silo. These figures are based on corn silage. Grass silage is heavier. Table 35 gives some idea of the size to construct.

TABLE 35—SIZES OF SILOS (TRENCH)

Number of Cows	Width at Top	Width at Bottom	Depth	Length	Capacity
	Feet	Feet	Feet	Feet	Tons
6	6	4	5	30	11
10	6	4	5	50	18
16	8	6	6	48	30
20	9	7	7	45	37
24	9	7	7	54	45
32	10	7	8	60	60
40	11	8	8	56	75
52	12	8	9	73	90

Based on 30 pounds or one cubic foot per day per cow for 125 days.

Feeding Silage:—When cows are stanchioned, it is customary to feed the grain mixture on the silage. If any difficulty is encountered with silage flavors in milk, it should be fed after milking. The usual rate of feeding is about 30 pounds of silage for Jersey and Guernsey cows and 35 to 40 pounds for Holsteins. This amount, of course, varies with the amount of silage and other feeds available.

When there is only a limited amount on hand, better results will be secured by feeding smaller amounts and feeding it over the entire winter feeding period. Where large quantities of silage are available, it may be fed heavily even up to about double the above amounts. If this is done the amount of hay should be decreased.

Table 36 shows the tons of silage needed for feeding various numbers of cows for different lengths of time at the usual rate of feeding.

TABLE 36—AMOUNT OF SILAGE NEEDED TO FEED VARIOUS NUMBERS OF COWS

Number of Cows	30 pounds daily		40 pounds daily	
	150 days	200 days	150 days	200 days
	tons	tons	tons	tons
10	22.5	30	30	40
20	45	60	60	80
30	67.5	90	90	120

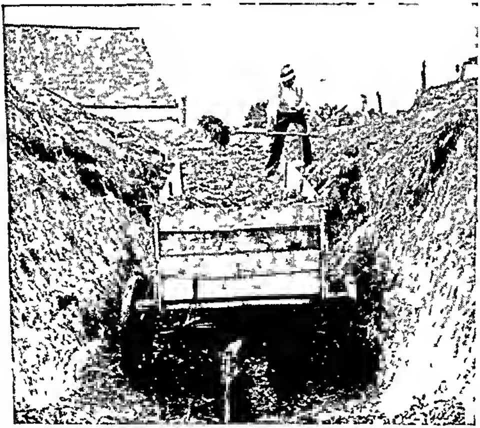
The Ensiling Process:—Silage is produced by the fermentation of sugar in green forage crops. Acid producing bacteria develop rapidly and produce organic acids from the sugars. These acids are largely lactic acid and acetic acid—the acids of sour milk and vinegar respectively. This process continues until the amount of acid present prevents further activity of the bacteria. The action of these acid forming bacteria retards the activity of protein decomposing organisms, and others which if allowed to develop would produce an undesirable odor and flavor in the silage.

Forage crops such as corn and sorghum which are high in carbohydrates ensile naturally, however, crops high in protein, especially young grasses and legumes will not ensile properly by themselves. Where there is a high percent of protein in the forage crop, protein decomposition takes place before sufficient acid is produced to retard it and a slimy, dark colored silage is produced which may have a foul odor. These crops may be put in the silo along with corn or sorghum in equal amounts and the mixture will ensile in a satisfactory manner.

Grass Silage:—The making of silage from green grasses and legumes will produce a splendid feed by the addition of fermentable carbohydrates or inorganic

acids. The use of molasses supplies sugars that are changed by the bacteria into organic acids which prohibit the activity of protein decomposing bacteria from developing very much. The use of inorganic acid supplies the acid condition without fermentation. Usually some fermentation does take place, but to a smaller extent.

The A. I. V. method is a patented process which uses a mixture of hydrochloric acid and sulphuric acid. In more recent years phosphoric acid has been used with satisfactory results. Ground corn or corn and cob meal added to the grass silage supplies carbohydrates for fermentation and has produced good silage.



Courtesy Ext. Ser. U. S. D. A.

Fig. 100. Loading Silage. The silage is being loaded on a wagon prior to hauling it to feed barn. It is necessary that sufficient removal be made daily to prevent spoilage.

Courtesy U. S. D. A.

Fig. 101. Silos for Experimental Work. They are located at the Beltsville Research Center of the U. S. D. A. at Beltsville, Maryland. They each hold about one ton of silage. Results of recent tests on grass and legume silage in these baby silos show that a farmer may feel safe in "canning his pasture" if he wilts the crop until it contains not more than 68% of moisture.

If the grass or legume crop is allowed to wilt in the field, it can be successfully ensiled without adding any preservatives. The Beltsville Experiment Station reports that it should be wilted to a moisture content of 65 to 68 per cent. This will still allow the cut material to pack but will not give much seepage.

Crops used for grass and legume silage vary widely throughout the country. A good forage crop cut before it is mature will produce a good grade of grass silage.

Overripe and otherwise poor quality forage cannot be made into a high quality silage. Any of the hay crops can be used as well as small grain crops The use of these crops instead of corn will reduce the acreage to be cultivated and fits well into a soil conservation program. A few dairymen carry the program out to the extent of operating no-plow farms as far as cultivation is concerned.

Putting Up Silage:—Preserving crops when weather conditions are unfavorable for curing hay by making grass silage is being used extensively. When there is excessive rainfall at haying time it may be impossible to cure the hay without great damage. The material can be put into the silo without the loss entailed in curing hay under such conditions. A great deal of the feeding value of hay is lost when it is rained on and handled extra times to get it sufficiently dry to store

Courtesy Ext. Ser U. S. D. A.

Fig. 102. Filling Trench Silo. It is necessary to pack the silage as it is being placed in a trench silo. This picture shows a horse being used. A tractor is sometimes used for this purpose

in the barn or stack. Putting it in the silo preserves all the leaves, softens the coarse stems and preserves most of the carotene and vitamin A in the crop.

It is more desirable to cut the green material and let it lie in the field long enough to thoroughly wilt it weather permits. If this is done there will be less seepage from the silo. Silage cutters with special hay feeding equipment make it easier to handle the green material at the cutter.

Some of the newer cutters have a molasses pump which will take the molasses from a drum on the ground. Where there is no pump a frame may be built just higher than the cutter, the drum of molasses can then be placed on the frame near the cutter. The molasses may then be put on by gravity through a pipe or hose to the cutter. The molasses may be diluted to facilitate even flow to the cutter. Acids may be put on in the same manner, but they will corrode the equipment. A separate pump and hose can be used so that the acid does not come in contact with the cutter, blower and pipe. The corn and cob meal can be spread on the cut silage in the silo.

Amount of Preservatives:—The amount of preservatives to use is determined by the kind of crop to be ensiled. Table 37 may be used as a guide for the amounts to be used for various types of crops. Some variations will not be harmful, and if no means are

TABLE 37—AMOUNT OF PRESERVATIVES TO USE

Silage Crop	Amount per ton of green material		
	Molasses	75% Phosphoric Acid	Corn and Cob Meal
Grasses and Cereals	40–50 lbs. (3½–4 gal.)	8–10 lbs. (5–6 pints)	100–150 lbs.
Grasses and Legumes Mixed	60–65 lbs. (5–5¼ gal.)	11–12 lbs. (6–7 pints)	200 lbs.
Legumes	70–80 lbs. (6–6½ gal.)	14–16 lbs. (8–9 pints)	250 lbs.

available for weighing a few loads of green material, it may be estimated.

Feeding Grass and Legume Silage:—This type of silage may be fed to replace corn silage or to replace a part of the hay. It may also be fed in connection with both corn silage and hay. It is a splendid feed for milking cows and young stock. Grass and legume silage contain more protein than corn and sorghum silage, therefore, less protein is needed in the grain mixture with it.

Cattle that are fed silage, preserved with the inorganic acids, need some additional minerals such as ground limestone, steamed bonemeal or other basic minerals to counteract the acids. Grass silage can be fed at the same rate as corn silage. Feeding after milking will eliminate the carry over of flavors to the milk. Winter milk from cows fed grass or legume silage will have more yellow color than that from cows that are fed most winter feeds.

SUGGESTIONS FOR STUDY

A. Questions and Problems

1. What are the advantages of using silos?
2. Why is silage a good milk producing feed?
3. How much silage should be fed off the silo per day?
4. Can trench silos be used in your section?
5. What are the advantages of a trench silo?
6. Make a list of the different kinds of silos in your community.
7. Which type is most popular? Why?
8. What crops in your locality are used for silage?
9. What advantages do grass and legume silages have over corn and sorghum silage?
10. What crops will produce the most feed per acre?

11. Why is it necessary to use a preservative with grasses and legumes for silage?
12. Which preservative do you prefer? Why? List your reasons.

B. Activities

1. Visit one or more dairy farms, when a silo is being filled and when it is being fed out.
2. Study the wastage of feed when silage is fed and when corn stover is fed.
3. If possible make a study of a trench silo, include cost of construction, size, amount of silage held and condition of silage.
4. Compare the winter milk production of dairymen using silos with some who do not have silage to feed.

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Chapter XIV

DAIRY BUILDINGS AND EQU

The dairy barn and milk house require more specific plans and construction than any other farm buildings. Regulations governing the production of market milk require specialized dairy barns, and in many cases, that they be used exclusively for milking cows. In such cases, separate buildings must be used for the housing of calves and heifers.

Dairy barns need not be expensively constructed, but must be sanitary. A plain, simply constructed barn may be more easily kept clean than some of the more elaborate barns. It should be well planned and conveniently arranged so that the time required for feeding, removing manure, cleaning cows and milking is kept to a minimum. For best results the cows must be comfortably housed.

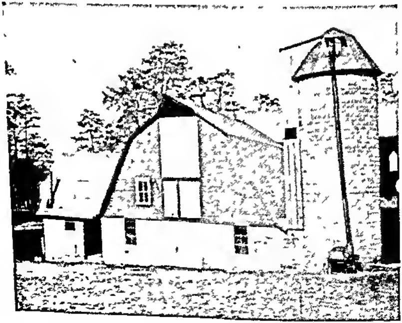
Location:—All dairy buildings should be located on a site that is well drained. This will help to keep the surroundings in a cleaner condition, especially since cows will go in and out of the barn more or less regularly. They may, of course, be kept in the barn during extreme cold or rainy spells. The location of the barn in relation to the other buildings is another consideration. It should be near enough to the house to facilitate the ease of going back and forth between the barn and house a great many times per day.

The barn should be where it is easy to get to from the main road, since the milk must be handled daily. It is, however, preferable not to have it too close to the main road. It should be accessible from the fields, in order to facilitate hauling in hay and silage. When

the site will permit, the barn should be built running north and south. This will allow sunlight to enter from both sides of the barn.

Types of Dairy Barns:—Dairy barns may be of any of the following types: (1) one story barn; (2) two story barn with hay storage overhead; and (3) small milking barn, with feeding barn for running cows loose.

The type of barn for any specific farm must depend on the individual needs. Where there is sufficient hay storage elsewhere, the single story barn is sufficient. The cost of construction is less than with those for feed storage. There is less danger from fire where no hay or bedding is stored overhead. The two story barns are the most popular kind because of the greater con-



Courtesy Ext. Ser. U. S. D. A.

Fig. 103. Dairy Barn. This barn is constructed of concrete blocks. The silo is built-in as part of barn.

venience of having the feed and bedding stored in the same barn where it is to be fed and used.

Where barns are already available that can be used for feeding barns and for housing the cows, except at milking time, the small milking barn will suffice. The cows are in the milking barn or milking parlor only at the time that they are milked. Usually they are fed grain in it.

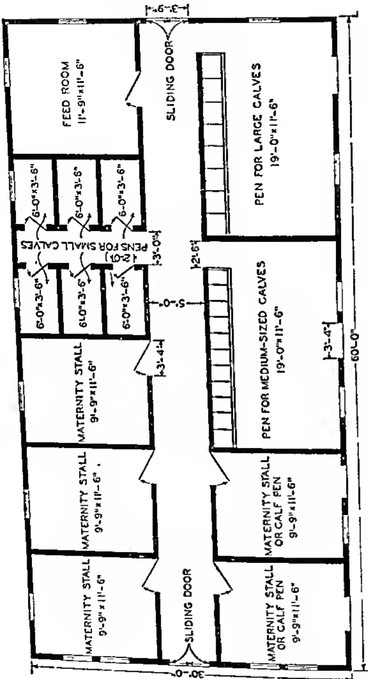
It is not necessary to have as many stalls as there are cows in the herd. A part of the herd can be milked at one time and turned out and then the others turned in for milking. This reduces the cost of construction and it is easier to maintain in a sanitary condition since no bedding is used, no hay is fed in it, and there is less space to keep clean. Sometimes an elaborate milking parlor and a combine milking unit are used with this system.

Plans and Specifications

A modern dairy barn plan with standard dimensions should be used. Such plans are available from the state extension service or from the inspection agency under which the barn will be used.

Floors:—The floors are generally made of concrete. Concrete is durable and easy to clean, and will meet all inspection requirements. The stall may be laid with cork brick or other types of material. The cork bricks are warmer and easier on the cow, but are more expensive, less durable and not so easily cleaned as concrete.

The concrete should be laid over a thick layer of cinders which will serve as an insulator and thus the concrete will not be so cold. The finish on the concrete in the litter alleys and in the stalls must not be made with a steel trowel. This makes too smooth and slick a floor, and will cause slipping and falling which may injure some cows. A wood float finish is suitable.



Courtesy U. S. D. A.

Fig. 104. Floor Plan for a Convenient Maternity and Calf Barn. Note the maternity stalls, individual pens for small calves, and large pens for medium-size and large calves.

All points should drain to the gutter. The entire floor should then have a slope toward one end to completely drain the barn. For the lengthwise slope one inch in ten feet is recommended. A one-inch slope for the feed and litter alleys and the stall will give good drainage and help to dry out the barn quickly after washing.

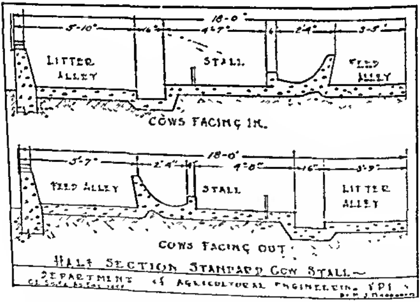
Gutters:—The standard size of the gutters is 16 inches wide with a depth of eight inches on the stall side and six inches on the alley side.

Mangers:—The width of mangers varies from two feet to two feet and four inches, depending in part on how high it is built up. A manger 12 inches deep is more satisfactory than a lower one. The feed alley may be level with the top of the manger, or built down with the level of the bottom of the manger. The latter is practiced when the depth of the manger is over 12 inches. When the alley is level with the top it is much easier to sweep back into the manger any feed that has been spilled or thrown out by the cows.

Courtesy N. C. State College Ext. Ser.

FIG. 105. Modern Barns. The N. C. State College dairy barns are shown here. They constitute the center of research in dairying in the Tar Heel State.

Stalls:—The size of the stalls varies with the size of the cows to be accommodated. The width varies from three feet and eight inches to four feet; and the length from manger to gutter varies from four feet and four inches to five feet and six inches. The difference in length may be taken care of by having different length stalls on the two lines of stalls, or the gutter may taper to have short stalls at one end and long ones at the other. This slight difference in the width of the alley from one end to the other is not objectionable. Also, many stanchions are made adjustable so that short cows can be pushed back and long cows pushed farther forward.



Courtesy Va. Extension Service

Fig. 106. Plan of a Dairy Barn Floor. The drawing gives a cross-section of a dairy barn floor (showing one-half of width of barn) for cows facing in and for cows facing out.

The standard range in the size for stalls is given in Table 38.

TABLE 38—STANDARD RANGE IN SIZE FOR STALLS FOR COWS

Breed	Stanchion barn stall			Box stall
	Width	Length	Length	
		Minimum	Maximum	
Ayrshire	3'8"	4'6'	4'10"	10 x10
Guernsey	3'8"	4'6"	4'10"	10 x10
Holstein and Brown Swiss	4'0'	4'10'	5'6"	10 x12'
Jersey	3'8'	4'4"	4'8"	8'x10

Facing Cows In or Out:—The barn may be arranged to either have the cows facing in or facing out. There are advantages and disadvantages to either system.

Fig. 107. Interior of Dairy Barn. This shows the interior of the dairy barn at the Virginia Polytechnic Institute, Blacksburg, Virginia. Note that the cows are facing out.

Facing out is somewhat preferable since there are no walls behind the cows which are hard to keep clean of manure. With both gutters together and only one litter alley some time is saved in cleaning the barn daily. With this arrangement a wagon or manure

spreader can be driven through the barn to take out the manure, if there is enough to justify doing so.

With the cows facing in, there is only one feed alley and some time may be saved in feeding.

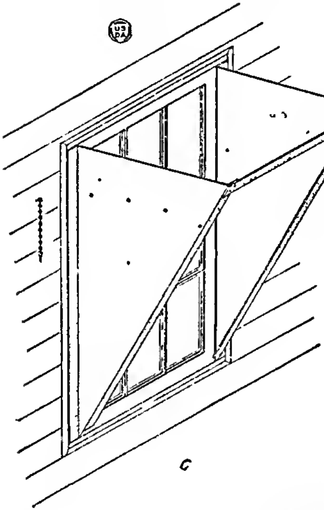
Litter and Feed Alleys:—If cows face in, the litter alleys should be five feet or more in width. When they face out, the one alley should be eight or nine feet wide. The side alleys should drain from the wall to the gutter and center alleys should have a center crown of one inch. The feed alleys may be somewhat narrower than the litter alleys since narrow feed carts are usually used. The standard width for a dairy barn is 36 feet.

Walls and Ceilings:—The walls should be finished smooth and without ledges to catch dirt and dust. It is advisable for the foundation to extend one foot or more above the floor level and preferably to the window, when the upper portion is to be wood. The upper part of the wall should be ceiled flush with the concrete to avoid a ledge. The overhead must be tight to avoid dirt falling through from the storage above. It should be smooth.

If all the interior is painted it will be much easier to keep clean. White wash is permissible on many markets but is not as satisfactory as paint for the milking barn.

Air Space:—The standard requirements for air space in a dairy barn is 500 to 600 cubic feet per cow. A barn 36 feet wide with normal width stalls and one or more cross alleys will need to be eight or nine feet from floor to ceiling. If there is much more space than this, the barn may get too cold at some periods during the winter.

Light:—Sunlight in abundance aids materially in keeping a barn in good condition. The presence of light enables one to see and remove dirt. Direct sunlight will



Courtesy U. S. D. A.

Fig. 108. Window for Dairy Barn. This drawing shows the window, which is used for light and ventilation. It is hinged at bottom with side shields to prevent draft.

help to dry out the barn and it will kill many bacteria. Four square feet of window glass per cow is standard for light in a dairy barn. This amount well distrbuted will supply sufficient light throughout the barn. Windows placed rather high will be better protected from breakage.

Ventilation:—In cold climates, it is essential to have a ventilation system in dairy barns. Even in moderate climates, where the barns are kept closed rather tightly during cold weather, there should be

some special means for controlling temperature in the barn.

Special air intakes with ventilating flues extending from the stable to the top of the roof are the most satisfactory. The air exchange should take place without a draft. Windows hinged at the bottom and with a side shield are used a great deal for ventilation in the South. Fresh air is most healthful and comfortable for the cows and will help to keep tho air free of "cowy" and "barny" odors.

Hay Storage:—To furnish sufficient hay and straw storage, it will suffice to allow approximately 500 cubic feet for a ton of hay and 600 cubic feet for a ton of straw. An average cow will need from one to two tons of hay for the winter feeding period, depending on how much silage is fed with it. From one-half to one ton of straw is needed for bedding. Cows kept in stanchions do not need as much bedding as they do when they are kept in box stalls or run loose in a lounging barn.

Lounging Barn:—The stanchion barn may be used only for milking and a separate barn or shed provided for the cows to stay in between milkings. This type of barn is referred to by several names, such as lounging barn, feeding barn, and tramp shed. The dry roughage and often the silage is fed in this barn. This system allows more freedom for the cows; however, it necessitates that they be dehorned.

Calf Barn:—It is desirable to have individual calf pens for calves during the milk feeding period. This allows less chance of one calf being infected with a disease from another. Separate stalls eliminate the practice of one calf sucking another, which may result in injury to the udder of a calf by stimulating it and causing abnormal development which may later cause weak or blind quarters.

The floor of the stalls should be constructed so they will drain well. Stalls with a floor space of 12 to 18 square feet are desirable. Where two or more calves are kept together, there should be stanchions or ties to fasten the calves while feeding milk.

The calf barn should be free of drafts, and have sufficient ventilation. In recent years, metal grating or heavy wire netting has been used in calf pens. The frame is placed on the floor of the pen with the grating three or four inches above the floor. It is then well bedded. All liquid will drain through the bedding and keep the stall in a fairly dry condition.

Box Stalls:—A few box stalls are always essential. They will be needed mostly for maternity stalls, where each cow can be placed before calving and can be kept for a few days after dropping calf. Box stalls are also needed to stable animals that are sick, lame, or for any reason that would make it desirable for them to be removed from the other cattle.

Barn Equipment

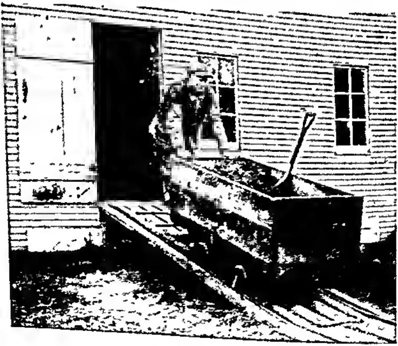
Stanchions and Chain Ties:—The usual means of fastening cows in a dairy barn is by use of stanchions. Rigid wooden stanchions are not satisfactory. They do not allow the cow sufficient comfort. The swinging steel stanchion meets practically all requirements for sanitation and comfort. However, a chain tie allows the cow more freedom and is easier on large cows and old cows than is the stanchion. The chain will not hold them in place quite as well and the cows will not stay as clean. It is easier to fasten the cows in the stanchion than to tie them with the chain ties.

Feed Carts:—A three wheel cart that will hold sufficient feed for one feeding is very convenient. The grain cart should have an arm fastened onto it on which to hang a feed scale. This makes it very easy

to weigh the grain mixture for each cow. The silage cart will need to be larger, but may be refilled one or more times depending on the number of cows to be fed. Some feed carts are run on overhead tracks.

Litter Carriers:—A good litter carrier goes a long way toward reducing the drudgery of cleaning the barn. It may be mounted on an overhead track or run on a small truck. The litter carrier should be large enough so that an excessive number of trips do not have to be made. The carrier may be dumped directly into a manure spreader or a manure pit.

Drinking Cups:—When cows are to remain in the barn, drinking cups are very desirable. They give the cows free access to water at all times. Cows will drink



Courtesy Ext. Ser. U. S. D. A.

Fig. 109. Feed Cart. This farmer is leaving his feed house with the feed cart.

more often and consume a greater amount of water than when watered twice a day. This is especially important when the water is near the freezing temperature. Cows will drink three to four pounds of water for each pound of milk produced, but heavy producers will

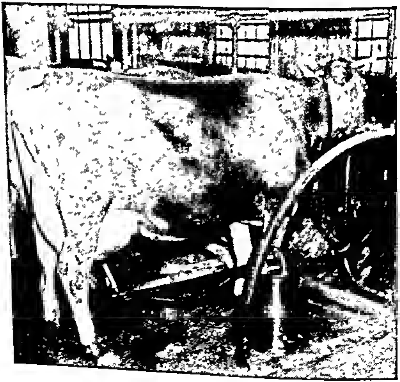
Courtesy U. S. D. A.

Fig. 110. Drinking Cup. When cows are to remain in the barn, drinking cups are very desirable. They give the cows free access to water at all times—thus resulting in their consuming greater amounts than when watered twice per day.

not drink enough when the water is very cold and when they are watered at long intervals.

The Iowa Experiment Station compared the production of cows watered twice daily with cows watered from drinking cups. Those having free access to the drinking cups produced 3.5% more milk than the other group. In localities where cows can be turned out throughout most of the year, drinking cups are not as essential as when cattle must be kept up a great deal of the time.

Milking Machines:—This is an age of increased use of farm machinery. With labor being drawn away from the farm, dairymen must of necessity look to labor



Courtesy DeLaval Separator Co

Fig. 111. Electric Milking Machine. Here is shown an electric milking machine in use.

Courtesy U S D A Extension Service

Fig. 112. Machine Stripping. Stripping a cow with a milking machine has proved satisfactory. This is done by pulling down on the teat cups with one hand while massaging the udder with the other hand The quarters that have not been completely milked out should be given the most massaging.

saving machinery. The milking machine is one that can be used every day in the year. It lessens the job of milking tremendously. There are a number of machines on the market that will do a good job of milking. Some dairymen eliminate most of the hand stripping by pulling down on the teat cups and massaging the udder just as the milking of the cow is being finished. This is called machine stripping and has proved satisfactory.

Good hand milkers will do a better job than the milking machine, however, the machine properly handled will do a better job than average hand milkers. Also, if the machines are thoroughly cleaned and handled carefully, they should produce a cleaner milk than hand milking. First calf heifers will start on the machine better than older cows that have been used to hand milking. Also a fresh cow can be placed on the

machine with less effect on her production than a cow later in her lactation period.

The Milk House

The milk house should be built separate from the barn and should not have an opening directly into it. The standard distance from the barn is ten feet with a covered walkway between. This distance and protection make it convenient to remove each pail of milk from the barn to the milk honse.

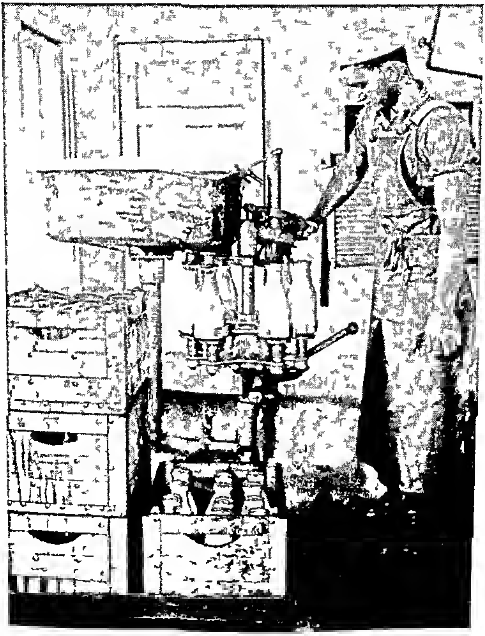
The standard milk house has three rooms, one for cooling, processing and storing milk, one for washing and sterilizing utensils and another for a boiler or hot water supply. When an electric heater is used to supply hot water, it may be placed in the wash room. This eliminates the boiler room. Concrete is the most desirable floor material. Laying metal grating in the top layer of concrete makes it much more durable. The

Courtesy Ext. Ser. U. S. D. A.

Fig. 113. Inside of Milk House. Some of the essential equipment for a dairy farm milk house is shown by this picture. To be of high quality, cleanliness in handling milk must be practiced.

floor should have a slope of one-fourth inch per foot. Sufficient windows should be put in to give plenty of sunlight to all parts of the rooms.

Since a great deal of water and steam must be used in the dairy house, some means of ventilation must be



Courtesy Ext. Ser U S. D A.

Fig. 114 Bottling Equipment. This is the equipment used for bottling milk on the Shelton Bros Dairy Farm, Brown County, Texas

supplied. Windows hinged at the bottom may be used, but are not as satisfactory as ventilator flues, which extend from the ceiling to above the roof.

The size of the rooms is determined by the amount of milk to be handled and the processing that is to be done. Ample room should be provided for handling the milk, for storage, washing and sterilizing equipment, and for utensils and cans. Like the dairy barn, the plan and construction of the milk house should be approved by the local health officer, under whose inspection the milk will be produced.

SUGGESTIONS FOR STUDY

A. Questions and Problems

1. Why is it necessary to build a dairy barn according to standard specifications?
2. For what reason does the dairy inspector require at least 500 cubic feet of air space and four square feet of window space per cow?
3. How can you accommodate cows of different sizes in a dairy barn?
4. What are the advantages of having cows face out rather than in?
5. What advantages are there in having the feed alley level with the top of the manger?
6. How deep and wide should the gutters be?
7. What are the advantages of individual calf stalls? How large should they be?
8. How far from the barn should the milk house be? Why?
9. In what ways do feed carts and litter carriers save labor?

B. Activities

1. Visit a dairy barn and study the arrangement of stalls, mangers, alleys and gutters. What kind of stanchions are installed? Check on the light and air space. What labor saving equipment is in use.
2. Secure dairy barn equipment catalogs. Study various types of equipment used in dairy barns.
3. Find out what the local milk inspector requires in regard to dairy barns and milk houses.

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3. Principles of Dairy Barn Ventilation, U. S. D. A. Farmers' Bul. 1392, Washington, D. C., 1924.
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CHAPTER XV

PRODUCING QUALITY DAIRY PRODUCTS

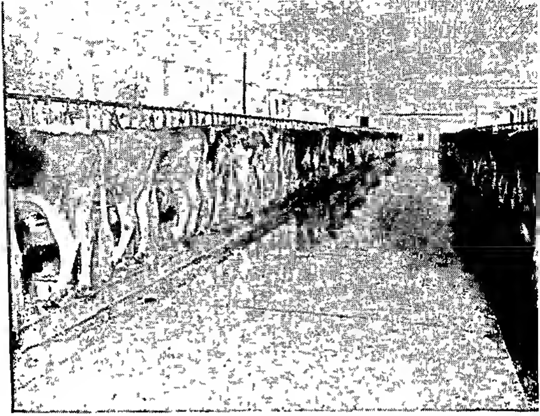
Milk is a universal food, not only for children but for adults as well. With greater emphasis being given to the nutrition of the people of this country, milk and dairy products are being looked to as part of the essential foods that must be consumed in greater amounts.

The production of milk by the farmer carries the responsibility of supplying to the consumer clean milk that is produced from clean, healthy cows, properly fed, and milked in sanitary surroundings. It must, also, be cooled and handled in clean, sterilized utensils and delivered fresh. Producing milk that is clean, that has a desirable flavor and has good keeping qualities is required of the commercial dairymen who are supplying the milk for distribution as fluid milk.

In the production of milk for manufacturing purposes and for use in the farm home sanitary practices should be carried out. This will insure a high quality product. Milk is easily contaminated if produced carelessly. The number of bacteria in milk indicates whether or not it has been handled in a clean manner and properly cooled. Milk furnishes a splendid medium for the growth and increase of bacteria. A low bacteria count in milk indicates that the milk was produced under sanitary conditions and cooled to a low temperature soon after milking.

Fluid Milk Production Regulated

The milk and cream that is sold in bottles for fluid consumption is called fluid milk or market milk. It is largely this milk that comes under the regulations of health department ordinances. Practically all cities



Courtesy Ext. Ser. U. S. D. A.

Fig. 115. A Clean Barn. A well planned barn that is kept clean, makes it much easier to use clean methods in producing milk.

have set up through their health departments, the regulations under which milk is to be produced to be sold within the city. Most small towns have their milk supply governed by state ordinances.

These regulations are set up to govern the conditions under which milk is produced, processed and delivered to the consumer, so as to insure a safe milk supply. While most bacteria in milk are not harmful, milk can be a carrier of some disease organisms, and it is because of this that strict inspection is made. The lactic acid bacteria which are most abundant in milk are not harmful, but they do change some of the milk sugar to lactic acid and cause milk to sour. Milk of low bacteria content will remain sweet longer.

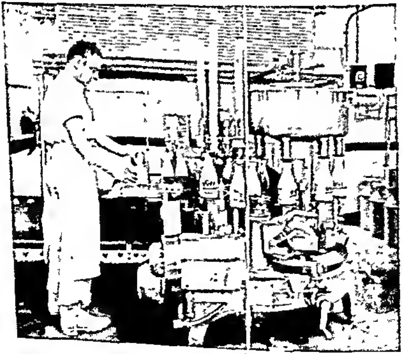
Factors in Producing High Grade Milk

The most essential factors for the production of high grade milk may be listed as follows:

1. Clean, healthy cows,

2. Properly constructed and clean barn and milk house,
3. Clean, healthy milkers and handlers,
4. Pure and abundant water supply,
5. Properly constructed, clean and sterile utensils,
6. Small top milk pails for hand milking and for stripping after machines,
7. Immediate cooling to a low temperature,
8. Storage at a low temperature, and
9. Delivery at a low temperature.

Cows:—The cows should be checked at least once a year by a veterinarian for tuberculosis and Bang's disease. They should be checked regularly for any udder trouble. Milk from infected udders should be



Courtesy Ext. Ser. U. S. D. A.

Fig. 116. Bottling Machine. This bottling machine is in use at the Wells Dairy Cooperative, Columbus, Georgia.

discarded. The cows should be observed for any other diseases and for general health.

The body of the cow, especially the flank and belly, is the greatest source of sediment and bacteria in milk. Particles of bedding and manure and loose hairs on the cow may fall into the pail during milking, unless the cow has been brushed before milking. The brushing should be done several minutes before milking so there will not be much dust in the air.

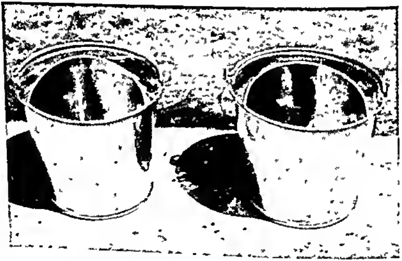
The clipping of the belly, udder and flanks will greatly facilitate the cleaning of the cow. A thorough brushing before each milking will reduce materially the contamination from this source. This brushing should be followed with the washing of the udder with

Courtesy Ext. Ser U. S. D. A.

FIG. 117. Clean Containers. The storage of milk in sanitary containers is one of the essential factors in the production of wholesome milk.

a cloth and water and preferably with water containing chlorine or some other sterilizing agent. There are several new chemical compounds (quaternary ammonium compounds) that are suitable for udder wash. They have an advantage over chlorine in that they do not cause the hands and teats to become chapped. The trade names of some of these are Roccal, Hyamine T, BTC, Emulsept, and Aldibac.

Barn:—A well planned barn, that is kept clean, makes it much easier to use clean methods in producing milk. If the barn meets the specifications of milk ordinances, it will contain sufficient light to make it easy



Courtesy Ext. Ser. U. S. D. A.

Fig. 118. Small-Top Milk Pails. One of the greatest sources of sediment in milk is for particles to fall into the milk pail from the cow's body. To reduce this, it is necessary to use the small-top milk pail.

to carry on the feeding, milking and cleaning operations. Ample air space and ventilation will keep the air free of "cowy" and "barny" odors which may be taken up in the milk.

A concrete floor or some other impervious material is easy to keep clean. Standard gutters help in keeping the cows clean. In winter when cows are kept in the barn a majority of the time, clean bedding such as

Courtesy U. S. D. A.

Fig. 119. Single Service Filters. They are used to strain milk from the pails into the large cans. They are used once and then thrown away. Dirty strainers are a source of serious contamination with bacteria.

straw, shavings or other available material is necessary.

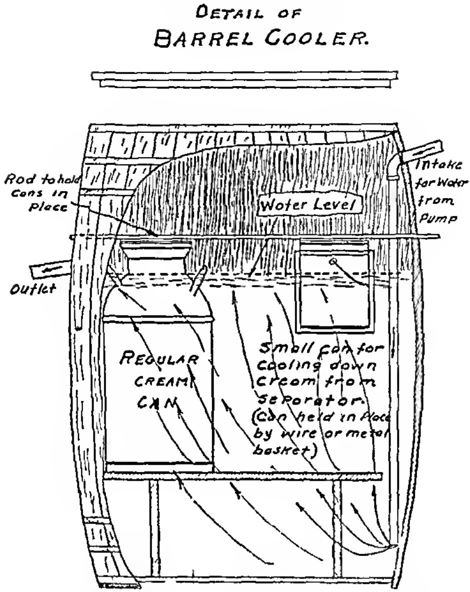
The manure should be taken ont of the gutters twice a day and if possible taken directly to the field. The barn can be kept in the best shape by washing it down after each milking, but when cows are bedded in the barn or where water for washing is not available, the use of gronnd limestone sprinkled in the gutter and litter alley is very satisfactory.

Feeding:—It is customary to feed the grain before milking, and hay after milking is completed. The feeding of hay usually causes some dust and should not be handled in the barn before milking. Silage is often fed before milking and the grain placed on top of it. This will, however, give some silage flavor in the milk and if it is very pronounced the silage should be fed after milking.

Many other feeds will produce feed flavors in milk when fed before milking but may not be carried over in the milk if fed after milking. Such feeds as turnips, cabbage, potatoes, rape and many green feeds will produce an abnormal flavor and odor in milk when it is fed within one hour before milking, but have practically no effect when fed after milking.

When cows are first turned on to rye and similar pastures, they should be taken off a few hours before milking and fed some dry hay. This will reduce the amount of "grassy" or "feed' flavor produced in the milk. Garlic or onions are present in many pastures and taint milk worse than any other common plant. While early removal from the pasture before milking will help some, the flavor is very persistent.

The Man in the Production of Clean Milk:—The personal element is, after all, the main factor in the production of high quality milk. A well constructed barn and splendid cows cannot produce clean milk when



Courtesy Virginia Extension Service

FIG. 120. Barrel Cooler. This illustration shows a cheap and simple cooling arrangement for cream or small quantities of milk.

poor methods are used by the attendants. All persons handling milk in any way should pass a medical examination. The general cleanliness of all equipment as well as the personal cleanliness of the milker is of the utmost importance.

Wet hand milking is not a sanitary method of milking. Suitable, clean clothing should be used during

Courtesy U. S. D. A.

Fig. 121. Cooling Milk. To produce high grade milk, it should be cooled immediately after milking. This is necessary to keep the bacteria count low.

milking and while handling the milk. Remove each pail of milk from the barn as soon as milked.

Water Supply:—Large quantities of water are needed on the dairy farm. The water supply should be tested for purity and to see that there is no contamination. The supply should be ample for all the necessary washing and cleaning.

Utensils:—Utensils that are used for handling milk should be constructed so that they can be easily and thoroughly cleaned. Utensils with crevices are very difficult to clean. In those that are well constructed all seams are flushed so that there are no crevices. Some utensils are made without seams.

One of the greatest sources of sediment in milk is for particles to fall into the milk pail from the cow's body or other sources. To reduce this, the small-top milk pail is universally required. The opening is only about one-fourth that of an open pail. This eliminates much of the sediment falling in the milk. The use of the covered pail is not objected to by the milker after he becomes accustomed to milking into it.

For cleaning, the utensil should first be rinsed with cold or warm water to remove the milk that remains. If hot water is used for this it will cook the milk onto the utensil and then it is very hard to remove. Next it should be washed with a stiff brush and an alkali washing powder in hot water. Neither wash cloth nor soap are effective in cleaning dairy equipment. Finally, the utensils should be rinsed to remove the washing powder and then sterilized with steam or with hot water at a temperature of at least 180° Fahrenheit.

Chemical sterlization may be used in some cases. There are a large number of commercial chlorine products on the market that are satisfactory. A very complete method is to sterilize with steam and then rinse with a chlorine solution just prior to using the utensil

Courtesy Rural Electrification Administration

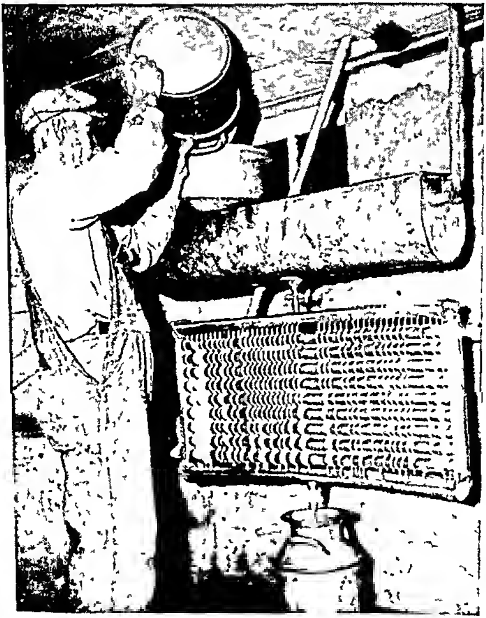
Fig. 122. Electric Refrigerator Cooler. Cans of milk may be set in an electrically cooled tank or refrigerator. The water should be agitated around the cans if this method is used.

the next time. A rack on which utensils can be inverted to dry and air out is desirable. Lids should not be placed on cans immediately after they are sterilized.

Milk is usually strained as a safeguard in case any foreign material has fallen into it. Single service strainer pads or filter pads are most desirable. They are discarded after using and are therefore not a source of contamination to the milk. These pads are made of a layer of cotton with gauze on one side.

Milking machines require careful cleaning and sterilization or they become a source of great contamination and may increase the bacteria count tremendously. However, with carefnl cleaning and opera-

tion of them, there is less chance of contamination than with hand milking. After the milking is completed, the teat cups and tubing should be rinsed by drawing cold or warm water (not hot) through them while the vacuum is still in the line. Then the machine



Courtesy U. S. D. A.

FIG. 123. Another Method of Cooling Milk. Cold water is run through the cooler and the milk runs slowly down the outside. This is an effective means for quick cooling.

should be washed in hot water and washing powder with special brushes and followed with sterilization. It should be thoroughly cleaned and sterilized after each nse.

High temperatures destroy rubber. Its life will be extended by the use of chemical sterilizers rather than steam. It is best applied by having a solution rack that will hold the teat cnps and a bottle of chlorine solution. The tubing and teat cups should be filled and allowed to stand until the next milking. The solntion should not be used but once. This eliminates dilution or reduction of the strength of the sterilizing agent. With this procednre for cleaning and sterilizing, it is still necessary to take the teat cups apart daily or at least twice a week, especially in summer, and wash the parts.

Cream separators should be taken apart after each use and treated as other utensils.

Cooling:—All milk produced under normal conditions contains some bacteria. Clean utensils, clean cows, and careful milking keep them at a minimum. If the bacteria connt is to remain low it is necessary to cool the milk soon after milking to a temperature at which the bacteria do not increase or increase very slowly. Very little growth takes place at 50° or below.

Table 39 shows the growth of bacteria in milk at different temperatures.

TABLE 39—GROWTH OF BACTERIA IN MILK AT DIFFERENT TEMPERATURES

Temperature of milk	Number of bacteria per cubic centimeter			
	at beginning	at 6 hours	at 12 hours	at 24 hours
50 degrees F.	10	12	15	41
60 degrees F.	10	17	242	61,280

From U.S.D.A. Farmers Bulletin 602.

Milk can be cooled satisfactorily by various methods. An aerator type of cooler, whereby cold water is run through the cooler and the milk runs slowly down the outside, is the most effective means for quick cooling. Cans of milk may be set in a tank of cold water with good results if the milk is stirred at intervals or if the water is agitated around the cans.

The use of ice or mechanical coolers is necessary to secure very low temperatures, whether the milk is cooled with an aerator or by immersing the cans in a tank of water. It is necessary to hold the milk at a low temperature during storage and delivery to maintain a low bacteria count and have a high grade milk.

Summary:—The production of high quality milk depends on: (1) healthy cows kept clean and fed wholesome feeds; (2) barn, milk house and utensils properly constructed and kept clean; (3) milk cooled

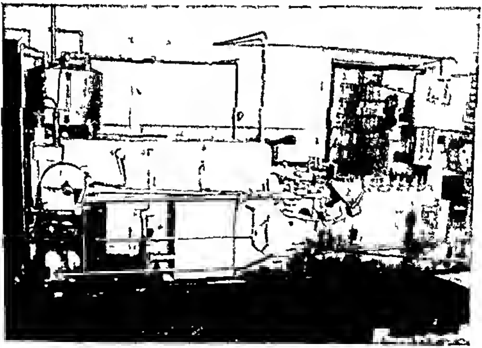
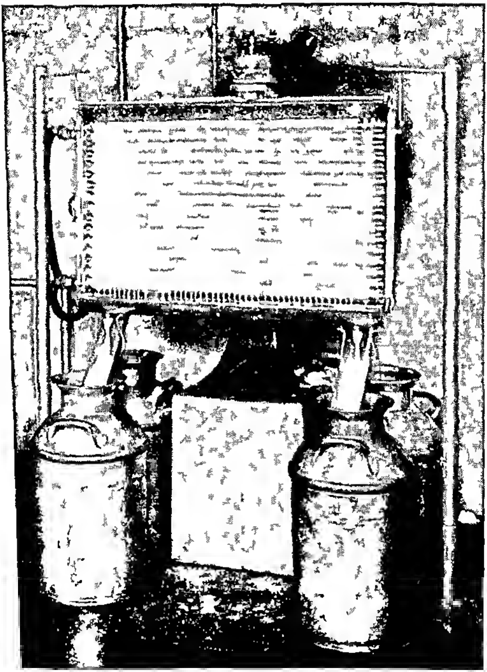


Fig. 124. Bottle Washer. This bottle washer is in use at the Athens Cooperative Creamery, Athens, Georgia. Bottles should be thoroughly cleaned and sterilized.

to a low temperature (50° Fahrenheit or lower under most conditions); (4) most of all, a dairyman who appreciates the necessity of absolute cleanliness of everything with which milk comes in contact, who realizes the value of quick cooling and proper storage, and who

Courtesy Ext. Ser. U. S. D. A.

Fig. 125. Separating Cream. Cream separators should be taken apart after each use and thoroughly cleaned and sterilized.



Courtesy Ext. Ser U S D A.

Fig 126 Standardizing Room Here is shown a cooler multi purpose standardizer and clarifier

is willing to carry out the details necessary to secure these conditions.

Milk for Manufacturing Purposes and Cream for Buttermaking

Sanitary conditions should be maintained for the production of milk for any purpose. However, in the production of milk for manufacturing purposes the main requirement is that it be delivered in a clean and sweet condition. Cream may be delivered sour but must be clean.

There are usually very few requirements for the barn and milk house when milk is marketed for manufacturing purposes or cream for buttermaking. Well water or spring water will suffice for cooling purposes rather than the more expensive mechanical refrigerator or ice. This class of milk sells at a lower price than that used for bottled milk or cream and therefore the cost of production must be kept lower.

SUGGESTIONS FOR STUDY

A. Questions and Problems

1. What is fluid or market milk?
2. Why is it more expensive to produce market milk than milk for manufacturing purposes
3. What milk products are manufactured at your local selling point?
4. Why feed silage after milking rather than before?
5. List three methods that you can use to sterilize dairy utensils?
6. Why use a small-top milk pail?

7. How would you keep milking machine equipment in a sanitary condition?
8. For what reason would you clip the hairs from the belly, udder and flanks of a cow?
9. Why are concrete floors more desirable than wood floors?
10. What is the advantage of cooling milk immediately after milking?
11. How would you determine that a cow is free of tuberculosis?
12. What kind of washing powder would you use for washing utensils?
13. Would you use a brush or cloth?
14. Why rinse milk from pails and other utensils with cold or warm water instead of hot water?
15. What are the requirements of a water supply for a dairy?

B. Activities

1. Visit a dairy farm and make a study of the following:
   (a) the method of cleaning cows;
   (b) time of feeding hay, grain and silage;
   (c) type of milk pail used;
   (d) cooling system;
   (e) temperature to which milk is cooled;
   (f) method of cleaning equipment; and
   (g) method of sterilizing equipment.

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CHAPTER XVI

MARKETING DAIRY PRODUCTS

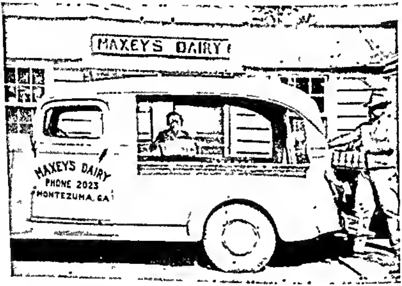
The dairy enterprise is as dependent upon efficient marketing for success as it is upon economical production. The bottle of milk left daily upon the consumer's doorstep represents marked progress as to quality and service when compared with the past when "loose" milk was sold by peddlers who measured their customer's requirements direct from can on dirty streets.

Investigate Local Market:—The dairy beginner would do well to investigate the local market before buying a farm or establishing a herd of cattle. Dairying is a highly competitive business. The Grade A fluid milk market requirements are very often being supplied by the local established dairymen. While market milk for fluid consumption generally brings the most profitable returns, the health and sanitary regulations require a heavy investment for barns, equipment, and milk houses. For this reason it is most important for a beginner to investigate the possibility of marketing his milk before making a great outlay for the necessary facilities.

Producer-Distributor:—Market milk may be sold direct to the consumer by the producer, who is known as a producer-distributor. The product may be sold as Grade A raw milk or Grade A pasteurized milk. Pasteurization means the process of heating milk to at least 143° F. and holding it at such temperature for at least 30 minutes. Immediately following this process, the milk is cooled to 35 to 40 degrees before bottling. If pasteurization is properly carried out, all pathogenic (disease producing) organisms will be destroyed; however, this process should not be used to avoid taking all

necessary sanitary precautions, such as are essential for producing Grade A raw milk.

Standard Milk Ordinance:—The United States Public Health Service, a unit of the Federal Security Agency, has drawn up a Standard Milk Ordinance which is recommended for adoption for all states, cities, and towns. It was designed to give communities safe milk at reasonable cost. In the development of this ordinance assistance was given by representatives of



Courtesy Ext. Ser. U. S. D. A.

Fig. 127. Milk Delivering Truck. Milk is being loaded into this truck for delivery to retail customers.

public health authorities, the United States Department of Agriculture, and the Dairy Industry.

This sanitary ordinance has been adopted in more than 2000 communities of the nation. The authority for the adoption of sanitary regulations for the production and sale of milk is usually vested in the governing body of each municipality, county, health district, or state. Since this ordinance with modifications has been

adopted generally in the South, it has been thought advisable to carry the provisions herewith in detail.

A MILK ORDINANCE

(Recommended by U. S. Public Health Service)

An ordinance defining "milk" and certain "milk products," "milk producer," "pasteurization, etc., prohibiting the sale of adulterated and misbranded milk and milk products, requiring permits for the sale of milk and milk products, regulating the inspection of dairy farms and milk plants, the examination, grading, labeling, placarding, pasteurization, regrading, distribution, and sale of milk and milk products, providing for the publishing of milk grades, the construction of future dairies and milk plants, the enforcement of this ordinance, and the fixing of penalties.

Be it ordained by the .... of the city of . .. . . as follows:

Section 1. Definitions:—The following definitions shall apply in the interpretation and the enforcement of this ordinance:

A. *Milk.*—Milk is hereby defined to be the lacteal secretion obtained by the complete milking of one or more healthy cows, excluding that obtained within 15 days before and 5 days after calving, or such longer period as may be necessary to render the milk practically colostrum free; which contains not less than 8 percent of milk solids not fat, and not less than 3¼ percent of milk fat.

B. *Milk fat or butter fat.*—Milk fat or butter fat is the fat of milk.

C. *Cream and sour cream.*—Cream is a portion of milk which contains not less than 18 percent milk fat. Sour cream is cream the acidity of which is more than 0.20 percent, expressed in lactic acid.

D. *Skimmed milk.*—Skimmed milk is milk from which a sufficient portion of milk fat has been re-

moved to reduce its milk-fat percentage to less than 3¼ percent.

E. *Milk or skimmed-milk beverage.*—A milk beverage or a skimmed-milk beverage is a food compound or confection consisting of milk or skimmed milk, as the case may be, to which has been added a sirup or flavor consisting of wholesome ingredients.

F. *Buttermilk.*—Buttermilk is a product resulting from the churning of milk or cream, or from the souring or treatment by a lactic acid or other culture of milk, skimmed milk, reconstituted skimmed milk, evaporated or condensed milk, of skimmed milk, or milk or skimmed-milk powder. It contains not less than 8 percent of milk solids not fat.

G. *Vitamin D milk.*—Vitamin D milk is milk the vitamin D content of which has been increased by a method and in an amount approved by the health officer.

H. *Reconstituted or recombined milk and cream.*—Reconstituted or recombined milk is a product resulting from the recombining of milk constituents with water and which complies with the standards for milk fat and solids not fat of milk as defined herein. Reconstituted or recombined cream is a product resulting from the combination of dried cream, butter, or butter fat with cream, milk, skim milk, or water.

I. *Goat Milk.*—Goat milk is the lacteal secretion, free from colostrum, obtained by the complete milking of healthy goats, and shall comply with all the requirements of this ordinance. The word "cows" shall be interpreted to include goats.

J. *Homogenized milk.*—Homogenized milk is milk which has been treated in such manner as to insure break-up of the fat globules to such an extent that after 48 hours storage no visible cream separation occurs on the milk and the fat percentage of the top 100

cc. of milk in a quart bottle, or of proportionate volumes in containers of other sizes, does not differ by more than 5 percent of itself from the fat percentage of the remaining milk as determined after thorough mixing.

K. *Milk products.*—Milk products shall be taken to mean and include cream, sour cream, homogenized milk, goat milk, vitamin D milk, buttermilk, skimmed milk, reconstituted or recombined milk and cream, milk beverages, skimmed-milk beverages, and any other product made by the addition of any substance to milk or any of these products and used for similar purposes and designated as a milk product by the health officer.

L. *Pasteurization.*—The terms "pasteurization," "pasteurized," and similar terms shall be taken to refer to the process of heating every particle of milk or milk products to at least 143° F., and holding at such temperature for at least 30 minutes, or to at least 160° F., and holding at such temperature for at least 15 seconds, in approved and properly operated equipment: *Provided,* That nothing contained in this definition shall be construed as disbarring any other process which has been demonstrated to be equally efficient and is approved by the State health authority.

M. *Adulterated milk and milk products.*—Any milk or milk product which contains any unwholesome substance, or which if defined in this ordinance does not conform with its definition, or which carries a grade label unless such grade label has been awarded by the health officer and not revoked, shall be deemed adulterated and misbranded.

N. *Milk producer.*—A milk producer is any person who owns or controls one or more cows, a part or all of the milk or milk products from which is sold or offered for sale.

O. *Milk distributor.*—A milk distributor is any person who offers for sale or sells to another any milk or milk products for human consumption as such.

P. *Dairy or dairy farm.*—A dairy or dairy farm is any place or premises where one or more cows are kept, a part or all of the milk or milk products from which is sold or offered for sale.

Q. *Milk plant.*—A milk plant is any place or premises or establishment where milk or milk products are collected, handled, processed, stored, bottled, pasteurized, or prepared for distribution.

R. *Health officer.*—The term "health officer" shall mean the health authority of the city of...................., or his authorized representative. The health officer of the County of........................., or his duly authorized representative, is hereby designated as health officer of the City of........................ for the purpose of the enforcement of this ordinance, and he or his duly authorized representative shall have full authority to enforce this ordinance within the corporate limits of the City of........................

S. *Average bacterial plate count, direct microscopic count, reduction time, and cooling temperature.*—Average bacterial plate count and average direct microscopic count shall be taken to mean the logarithmic average, and average reduction time and average cooling temperature shall be taken to mean the arithmetic average, of the respective results of the last four consecutive samples, taken upon separate days, irrespective of the date of grading or regrading.

T. *Grading period.*—The grading period shall be such period of time as the health officer may designate within which grades shall be determined for all milk and milk products, provided that the grading period shall in no case exceed 6 months.

U. *Person.*—The word "person" as used in this ordinance shall mean "person, firm, corporation, or association."

V. *And/or.*—Where the term "and/or" is used "and" shall apply where possible, otherwise "or" shall apply.

Section 2. The sale of adulterated, misbranded, or ungraded milk or milk products prohibited:—No person shall within the city of..............................., or its police jurisdiction, produce, sell, offer, or expose for sale, or have in possession with intent to sell, any milk or milk product which is adulterated, misbranded, or ungraded. It shall be unlawful for any person, elsewhere than in a private home, to have in possession any adulterated, misbranded, or ungraded milk or milk product.

Section 3. Permits:—It shall be unlawful for any person to bring into or receive into the city of......................................., or its police jurisdiction, for sale, or to sell, or offer for sale therein, or to have in storage where milk or milk products are sold or served, any milk or milk product defined in this ordinance, who does not possess a permit from the health officer of the city of...................................

Only a person who complies with the requirements of this ordinance shall be entitled to receive and retain such a permit.

Such a permit may be suspended by the health officer, or revoked after an opportunity for a hearing by the health officer, upon the violation by the holder of any of the terms of this ordinance.

Section 4. Labeling and Placarding:—All bottles, cans, packages, and other containers enclosing milk or any milk product defined in this ordinance shall be plainly labeled or marked with (1) the name of the contents as given in the definitions of this ordinance; (2) the grade of the contents; (3) the word "pasteur-

ized" only if the contents have been pasteurized; (4) the word "raw" only if the contents are raw; (5) the phrase "for pasteurization" if the contents are to be pasteurized; (6) the name of the producer if the contents are raw, and the name of the plant at which the contents were pasteurized, if the contents are pasteurized; and (7) in the case of vitamin D milk, the designation "Vitamin D Milk" and the source of the vitamin D. The label or mark shall be in letters of a size, kind, and color approved by the health officer and shall contain no marks or words which are misleading.

Every restaurant, cafe, soda fountain, or other establishment serving milk or milk products shall display at all times, in a place designated by the health officer, a notice approved by the health officer, stating the lowest grade of milk and/or milk products served.

Section 5. Inspection of dairy farms and milk plants for the purpose of grading or regrading:—At least once during each grading period the health officer shall inspect all dairy farms and all milk plants whose milk or milk products are intended for consumption within the city of........................, or its police jurisdiction. In case the health officer discovers the violation of any item of sanitation, he shall make a second inspection after a lapse of such time as he deems necessary for the defect to be remedied, but not before the lapse of 3 days; and the second inspection shall be used in determining the grade of milk and/or milk products. Any violation of the same item of this ordinance on two consecutive inspections shall call for immediate degrading.

One copy of the inspection report shall be posted by the health officer in a conspicuous place upon an inside wall of one of the dairy farm or milk plant buildings, and said inspection report shall not be defaced or removed by any person except the health officer. Another

copy of the inspection report shall be filed with the records of the health department.

Section 6. The examination of milk and milk products:—During each grading period at least four samples of milk and cream from each dairy farm and each milk plant shall be taken on separate days and examined by the health officer. Samples of other milk products may be taken and examined by the health officer as often as he deems necessary. Samples of milk and milk products from stores, cafes, soda fountains, restaurants, and other places where milk or milk products are sold shall be examined as often as the health officer may require. Bacterial plate counts and direct microscopic counts shall be made in conformity with the latest standard methods recommended by the American Public Health Association. Examinations may include such other chemical and physical determinations as the health officer may deem necessary for the detection of adulteration, these examinations to be made in accordance with the latest standard methods of the American Public Health Association and the Association of Official Agricultural Chemists. Samples may be taken by the health officer at any time prior to the final delivery of the milk or milk products. All proprietors of stores, cafes, restaurants, soda fountains, and other similar places shall furnish the health officer, upon his request, with the names of all distributors from whom their milk and milk products are obtained. Bioassays of the vitamin D content of vitamin D milk shall be made when required by the health officer in a laboratory approved by him for such examinations.

Whenever the average bacterial count, the average reduction time, or the average cooling temperature falls beyond the limit for the grade then held, the health officer shall send written notice thereof to the person concerned, and shall take an additional sample,

but not before the lapse of 3 days, for determining a new average in accordance with section 1 (S). Violation of the grade requirement by the new average or by any subsequent average during the remainder of the current grading period shall call for immediate degrading or suspension of the permit, unless the last individual result is within the grade limit.

Section 7. The grading of milk and milk products: —At least once every six months the health officer shall announce the grades of all milk and milk products delivered by all producers or distributors and ultimately consumed within the city of........................, or its police jurisdiction. Said grades shall be based upon the following standards, the grading of milk products being identical with the grading of milk except that the bacterial standards shall be doubled in the case of cream, and omitted in the case of sour cream and buttermilk. Vitamin D milk shall be only of grade A or grade B pasteurized, certified, or grade A raw quality.

Certified Milk-Raw.—Certified milk-raw is raw milk which conforms with the requirements of the American Association of Medical Milk Commissions in force at the time of production and is produced under the supervision of a medical milk commission and of the State board of health or of the city or county health officer of..............................

Grade A Raw Milk.—Grade A raw milk is raw milk the average bacterial count of which as determined under sections 1 (S) and 6 of this ordinance does not exceed 50,000 per cubic centimeter, or the average direct microscopic count of which does not exceed 50,000 per cubic centimeter if clumps are counted or 200,000 per cubic centimeter if individual organisms are counted, or the average reduction time of which is not less than 8 hours: *Provided,* That if it is to be pasteurized the corresponding limits shall be 200,000 per cubic

centimeter, 200,000 per cubic centimeter, 800,000 per cubic centimeter, and 6 hours, respectively; and which is produced upon dairy farms conforming with all of the following items of sanitation.

ITEM 1r. *Cows, tuberculosis and other diseases.*—Except as provided hereinafter, a tuberculin test of all herds and additions thereto shall be made before any milk therefrom is sold, and at least once every 12 months thereafter, by a licensed veterinarian approved by the State livestock sanitary authority. Said tests shall be made and any reactors disposed of in accordance with the requirements approved by the United States Department of Agriculture, Bureau of Animal Industry for accredited herds. A certificate signed by the veterinarian or attested to by the health officer and filed with the health officer shall be evidence of the above test: *Provided,* That in modified accredited counties in which the modified accredited area plan is applied to the dairy herds the modified accredited area system approved by the United States Bureau of Animal Industry shall be accepted in lieu of annual testing.

All milk and milk products consumed raw shall be from herds or additions thereto which have been found free from Bang's disease, as shown by blood serum tests for agglutinins against *Brucella abortus* made in a laboratory approved by the health officer. All such herds shall be retested at least every twelve months and all reactors removed from the herd. A certificate identifying each animal by number, and signed by the laboratory making the test, shall be evidence of the above test.

Cows which show an extensive or entire induration of one or more quarters of the udder upon physical examination, whether secreting abnormal milk or not, shall be permanently excluded from the milking herd. Cows giving bloody, stringy, or otherwise abnormal

milk, but with only slight induration of the udder, shall be excluded from the herd until re-examination shows that the milk has become normal.

For other diseases such tests and examinations as the health officer may require shall be made at intervals and by methods prescribed by him, and any diseased animals or reactors shall be disposed of as he may require.

ITEM 2r. *Dairy barn, lighting.*—A dairy or milking barn shall be required and in such sections thereof where cows are milked windows shall be provided and kept clean and so arranged as to insure adequate light properly distributed, and when necessary shall be provided with adequate supplementary artificial light.

ITEM 3r. *Dairy barn, air space and ventilation.*—Such sections of all dairy barns where cows are kept or milked shall be well ventilated and shall be so arranged as to avoid overcrowding.

ITEM 4r. *Dairy barn, floors.*—The floors and gutters of such parts of all dairy barns in which cows are milked shall be constructed of concrete or other approved impervious and easily cleaned material, shall be graded to drain properly, and shall be kept clean and in good repair. Water shall be piped into the dairy barn under pressure. No horses, pigs, fowl, calves, etc., shall be permitted in parts of the barn used for milking.

ITEM 5r. *Dairy barn, walls and ceilings.*—The walls and ceilings of all dairy barns shall be whitewashed once each year or painted once every two years, or oftener if necessary, or finished in an approved manner, and shall be kept clean and in good repair. In case there is a second story above that part of the barn in which cows are milked, the ceiling shall be tight. If the feed room adjoins the milking space, it shall be separated therefrom by a dust-tight partition and door.

No feed shall be stored in the milking portion of the barn.

ITEM 6r. *Dairy barn, cow yard.*—All cow yards shall be graded and drained as well as practicable and kept clean.

ITEM 7r. *Manure disposal.*—All manure shall be removed and stored or disposed of in such manner as best to prevent the breeding of flies therein or the access of cows to piles thereof.

ITEM 8r. *Milk house or room, construction.*—There shall be provided a milk house or milk room in which the cooling, handling, and storing of milk and milk products and the washing, bactericidal treatment, and storing of milk containers and utensils shall be done. (a) The milk house or room shall be provided with a tight floor constructed of concrete or other impervious material, in good repair, and graded to provide proper drainage. (b) It shall have walls and ceilings of such construction as to permit easy cleaning, and shall be well painted or finished in an approved manner. (c) It shall be well lighted and ventilated. (d) It shall have all openings effectively screened including outward-opening, self-closing doors, unless other effective means are provided to prevent the entrance of flies. (e) It shall be used for no other purposes than those specified above except as may be approved by the health officer; shall not open directly into a stable or into any room used for domestic purposes; shall have water piped into it under pressure, and shall be provided with adequate facilities for the heating of water for the cleaning of utensils; shall be equipped with a two-compartment stationary wash and rinse vat, except that in case of retail raw milk, if chlorine is employed as the principal bactericidal treatment, the three-compartment type must be used; and in the case of milk for pasteurization, if chlorine is employed as the principal bacteri-

cidal agent, three-compartment vats shall be required for replacements and new construction; and shall, unless the milk is to be pasteurized, be partitioned to separate the handling of milk and the storage of cleaned utensils from the cleaning and other operations, which shall be so located and conducted as to prevent any contamination of the milk or of cleaned equipment.

ITEM 9r. *Milk house or room, cleanliness and flies.*—The floors, walls, ceilings, and equipment of the milk house or room shall be kept clean at all times. All means necessary for the elimination of flies shall be used.

ITEM 10r. *Toilet.*—Every dairy farm shall be provided with one or more flush toilets convenintly located, and connected to an approved sewage disposal system, or with one or more sanitary privies conveniently located, constructed, operated and maintained in accordance with the recommendations of the State Board of Health.

ITEM 11r. *Water Supply.*—The water supply for the milk house or room and dairy barn shall be properly located, constructed and operated, and shall be easily accessible, adequate, and of safe sanitary quality.

ITEM 12r. *Utensils, Construction.*—All multi-use containers or other utensils used in the handling, storage, or transportation of milk or milk products must be made of smooth nonabsorbent material and of such construction as to be easily cleaned, and must be in good repair. Joints and seams shall be soldered flush. Woven wire cloth shall not be used for straining milk. All milk pails shall be of small-mouth design approved by the health officer. The manufacture, packing, transportation, and handling of single-service containers and container caps and covers shall be conducted in a sanitary manner. All strainers shall be equipped with sterilized single-service filter discs.

ITEM 13*r*. *Utensils, cleaning.*—All multi-use containers, equipment, and other utensils used in the handling, storage, or transportation of milk and milk products must be thoroughly cleaned as soon as practicable after each usage.

ITEM 14*r*. *Utensils, bactericidal treatment.*—All multi-use containers, equipment, and other utensils used in the handling, storage, or transportation of milk or milk products shall between each usage be subjected to an approved bactericidal process with steam, chlorine, or hot air.

ITEM 15*r*. *Utensils, storage.*—All containers and other utensils used in the handling, storage, or transportation of milk or milk products shall be stored so as not to become contaminated before being used. Filter discs shall be kept in the original container and stored in closed cabinets.

ITEM 16*r*. *Utensils, handling.*—After bactericidal treatment no container or other milk product utensil shall be handled in such manner as to permit any part of any person or his clothing to come in contact with any surface with which milk or milk products come in contact.

ITEM 17*r*. *Milking, udders and teats, abnormal milk.*—The udders and teats of all milking cows shall be clean and rinsed with a bactericidal solution at the time of milking. Abnormal milk shall be kept out of the milk supply and shall be so handled and disposed of as to preclude the infection of the cows and the contamination of milk utensils.

ITEM 18*r*. *Milking, flanks.*—The flanks, bellies, hind legs, and tails of all milking cows shall be free from visible dirt at the time of milking.

ITEM 19*r*. *Milkers' hands.*—Milkers' hands shall be clean, rinsed with a bactericidal solution, and dried

with a clean towel immediately before milking and following any interruption in the milking operation. Wet-hand milking is prohibited. Convenient facilities shall be provided for the washing of milkers' hands.

ITEM 20r. *Clean clothing.*—Milkers and milk handlers shall wear clean outer garments while milking or handling milk, milk products, containers, utensils, or equipment.

ITEM 21r. *Milk stools.*—Milk stools shall be kept clean.

ITEM 22r. *Removal of milk.*—Each pail of milk shall be removed immediately to the milk house or straining room. No milk shall be strained or poured in the dairy barn.

ITEM 23r. *Cooling.*—Milk must be cooled immediately after completion of milking to 50° F., or less, and maintained at that average temperature, as defined in Section 1 (S), until delivery. If milk is delivered to a milk plant or receiving station for pasteurization or separation, it must be delivered within 2 hours after completion of milking or cooled to 70° F., or less and maintained at that average temperature until delivered.

ITEM 24r. *Bottling and Capping.*—Milk and milk products shall be bottled and capped by means of an approved combination bottling and capping machine. Caps or cap stock shall be purchased in sanitary containers and kept therein in a clean dry place until used. Cap containers shall be stored so as to prevent contamination. Hand capping is prohibited.

ITEM 25r. *Personnel, Health.*—The health officer or a physician authorized by him shall examine and take a careful morbidity history of every person connected with a retail raw dairy, or about to be employed, whose work brings him in contact with the production, han-

dling, storage, or transportation of milk, milk products, containers, or equipment. If such examination or history suggests that such person may be a carrier of or infected with the organisms of typhoid or paratyphoid fever or any other communicable diseases likely to be transmitted through milk, he shall secure appropriate specimens of body discharges and cause them to be examined in a laboratory approved by him or by the State health authorities for such examinations, and if the results justify such person shall be barred from such employment.

Such persons shall furnish such information, submit to such physical examinations, and submit such laboratory specimens as the health officer may require for the purpose of determining freedom from infection.

ITEM 26r. *Miscellaneous.*—All vehicles used for the transportation of milk or milk products shall be so constructed and operated as to protect their contents from the sun and from contamination. All vehicles used for the transportation of milk or milk products in their final delivery containers shall be constructed with permanent tops and with permanent or roll-down sides and back, provided that openings of the size necessary to pass the delivery man may be permitted in the sides or back for loading and unloading purposes. All vehicles shall be kept clean, and no substance capable of contaminating milk or milk products shall be transported with milk or milk products in such manner as to permit contamination. All vehicles used for the distribution of milk or milk products shall have the name of the distributor prominently displayed.

The immediate surroundings of the dairy shall be kept in a neat, clean condition.

Grade B raw milk.—Grade B raw milk is raw milk which violates the bacterial standard and/or the abortion testing requirement for grade A raw milk, but

which conforms with all other requirements for grade A raw milk, and has an average bacterial plate count not exceeding 1,000,000 per cubic centimeter, or an average direct microscopic count not exceeding 1,000,000 per cubic centimeter if clumps are counted or 4,000,000 per cubic centimeter if individual organisms are counted, or an average reduction time of not less than 3½ hours, as determined under sections 1 (S) and 6.

Grade C raw milk.—Grade C raw milk is raw milk which violates any of the requirements for grade B raw milk.

Certified milk-pasteurized.—Certified milk-pasteurized is certified milk-raw which has been pasteurized, cooled, and bottled in a milk plant conforming with the requirements for grade A pasteurized milk.

Grade A pasteurized milk.—Grade A pasteurized milk is grade A raw milk, with such exceptions as are indicated if the milk is to be pasteurized, which has been pasteurized, cooled, and bottled in a milk plant conforming with all of the following items of sanitation and the average bacterial plate count of which at no time after pasteurization and until delivery exceeds 30,000 per cubic centimeter, as determined under sections 1 (S) and 6.

The grading of a pasteurized-milk supply shall include the inspection of receiving and collecting stations with respect to items 1p to 15p, inclusive, and 17p, 19p, 22p, and 23p, except that the partitioning requirement of item 5p shall not apply.

ITEM 1p. *Floors*—The floors of all rooms in which milk or milk products are handled or stored or in which milk utensils are washed shall be constructed of concrete or other equally impervious and easily cleaned material and shall be smooth, properly drained, provided with trapped drains, and kept clean.

ITEM 2p. *Walls and ceilings.*—Walls and ceilings of rooms in which milk or milk products are handled or stored or in which milk utensils are washed shall have a smooth, washable, light-colored surface and shall be kept clean.

ITEM 3p. *Doors and windows.*—Unless other effective means are provided to prevent the access of flies, all openings into the outer air shall be effectively screened and doors shall be self-closing.

ITEM 4p. *Lighting and ventilation.*—All rooms shall be well lighted and ventilated.

ITEM 5p. *Miscellaneous protection from contamination.*—The various milk-plant operations shall be so located and conducted as to prevent any contamination of the milk or of the cleaned equipment. All means necessary for the elimination of flies shall be used. There shall be separate rooms for (a) the pasteurizing, processing, cooling, and bottling operations, and (b) the washing and bactericidal treatment of containers. Cans of raw milk shall not be unloaded directly into the pasteurizing room. Pasteurized milk or milk products shall not be permitted to come in contact with equipment with which unpasteurized milk or milk products have been in contact, unless such equipment has first been thoroughly cleaned and subjected to bactericidal treatment. Rooms in which milk, milk products, cleaned utensils, or containers are handled or stored shall not open directly into any stable or living quarters. The pasteurization plant shall be used for no other purposes than the processing of milk and milk products and the operations incident thereto, except as may be approved by the health officer.

ITEM 6p. *Toilet facilities.*—Every milk plant shall be provided with toilet facilities conforming with the ordinances of the city of.................................... Toilet

rooms shall not open directly into any room in which milk, milk products, equipment, or containers are handled or stored. The doors of all toilet rooms shall be self-closing. Toilet rooms shall be kept in a clean condition, in good repair, and well ventilated. No privies shall be permitted at any milk plant.

ITEM 7p. *Water supply.*—The water supply shall be easily accessible, adequate, and of a safe, sanitary quality.

ITEM 8p. *Hand-washing facilities.*—Convenient hand-washing facilities shall be provided, including warm running water, soap, and approved sanitary towels. The use of a common towel is prohibited.

ITEM 9p. *Sanitary piping.*—All piping used to conduct milk or milk products shall be "sanitary milk piping" of a type which can be easily cleaned with a brush. Pasteurized milk and milk products shall be conducted from one piece of equipment to another only through sanitary milk piping.

ITEM 10p. *Construction and repair of containers and equipment.*—All multiple-use containers and equipment with which milk or milk products come in contact shall be constructed in such manner as to be easily cleaned and shall be kept in good repair. The manufacture, packing, transportation, and handling of single-service containers and container cups and covers shall be conducted in a sanitary manner.

ITEM 11p. *Disposal of wastes.*—All wastes shall be properly disposed of.

ITEM 12p. *Cleaning and bactericidal treatment of containers and equipment.*—All milk and milk products containers and equipment, except single-service containers, shall be thoroughly cleaned after each usage. All containers shall be subjected to an approved bactericidal process after each cleaning and all equipment

immediately before each usage. When empty and before being returned to a producer by a milk plant each container shall be effectively cleaned and subjected to bactericidal treatment.

ITEM 13*p*. *Storage of containers and equipment.*—After bactericidal treatment all bottles, cans, and other multi-use milk or milk-products containers and equipment shall be stored in such manner as to be protected from contamination.

ITEM 14*p*. *Handling of containers and equipment.*—Between bactericidal treatment and usage, and during usage, containers and equipment shall not be handled or operated in such manner as to permit contamination of the milk.

ITEM 15*p*. *Storage of caps, parchment paper, and single-service containers.*—Milk bottle caps or cap stock, parchment paper for milk cans, and single-service containers shall be purchased and stored only in sanitary tubes and cartons, respectively, and shall be kept therein in a clean dry place.

ITEM 16*p*. *Pasteurization.*—Pasteurization shall be performed as described in section 1 (L) of this ordinance.

ITEM 17*p*. *Cooling.*—All milk and milk products received for transportation shall immediately be cooled in approved equipment to 50° F. or less and maintained at that temperature until pasteurized, unless they are to be pasteurized within 2 hours after receipt; and all pasteurized milk and milk products shall be immediately cooled in approved equipment to an average temperature of 50° F., or less, as defined in section 1 (S), and maintained thereat until delivery.

ITEM 18*p*. *Bottling.*—Bottling of milk and milk products shall be done at the place of pasteurization in approved mechanical equipment.

ITEM 19*p*. *Overflow milk.*—Overflow milk or milk products shall not be sold for human consumption.

ITEM 20*p*. *Capping.*—Capping of milk and milk products shall be done by approved mechanical equipment. Hand capping is prohibited. The cap or cover shall cover the pouring lip to at least its largest diameter.

ITEM 21*p*. *Personnel, Health.*—The health officer or a physician authorized by him shall examine and take a careful morbidity history of every person connected with a pasteurization plan, or about to be employed, whose work brings him in contact with the production, handling, storage, or transportation of milk, milk products, containers, or equipment. If such examination or history suggests that such person may be a carrier of or infected with the organisms of typhoid or paratyphoid fever or any other communicable diseases likely to be transmitted through milk, he shall secure appropriate specimens of body discharges and cause them to be examined in a laboratory approved by him or by the State health authorities for such examinations, and if the results justify person such be barred from such employment.

Such persons shall furnish such information, submit to such physical examinations, and submit such laboratory specimens as the health officer may require for the purpose of determining freedom from infection.

ITEM 22*p*. *Personnel, cleanliness.*—All persons coming in contact with milk, milk products, containers, or equipment shall wear clean outer garments and shall keep their hands clean at all times while thus engaged.

ITEM 23*p*. *Miscellaneous.*—All vehicles used for the transportation of milk or milk products shall be so constructed and operated as to protect their contents from the sun and from contamination. All vehicles used for

the transportation of milk or milk products in their final delivery containers shall be constructed with permanent tops and with permanent or roll-down sides and back, provided that openings of the size necessary for the delivery man may be permitted in the sides or back for loading and unloading purposes. All vehicles shall be kept clean, and no substance capable of contaminating milk or milk products shall be transported with milk or milk products in such manner as to permit contamination. All vehicles used for the distribution of milk or milk products shall have the name of the distributor prominently displayed.

The immediate surroundings of the milk plant shall be kept in a neat, clean condition.

Grade B pasteurized milk.—Grade B pasteurized milk is pasteurized milk which violates the bacterial standard for grade A pasteurized milk and/or the provision of lip-cover caps of item 20p and/or the requirement that grade A raw milk be used, but which conforms with all other requirements for grade A pasteurized milk, has been made from raw milk of not less than grade B quality, and has an average bacterial plate count after pasteurization and before delivery not exceeding 50,000 per cubic centimeter, as determined under sections 1 (S) and 6.

Grade C pasteurized milk.—Grade C pasteurized milk is pasteurized milk which violates any of the requirements for grade B pasteurized milk.

Section 8. Grades of milk and milk products which may be sold:—From and after 12 months from the date on which this ordinance takes effect no milk or milk products shall be sold to the final consumer or to restaurants, soda fountains, grocery stores, or similar establishments except . . . .
Provided, That when any milk distributor fails to qualify for one of the above grades the health officer is au-

thorized to revoke his permit, or in lieu thereof to degrade his product and permit its sale during a temporary period not exceeding 30 days or in emergencies such longer period as he may deem necessary.

Section 9. Supplementary grading prescribed and regrading authorized:—If, at any time between the regular announcements of the grades of milk or milk products, a lower grade shall become justified, in accordance with sections 5, 6, and 7 of this ordinance, the health officer shall immediately lower the grade of such milk or milk products, and shall enforce proper labeling and placarding thereof.

Any producer or distributor of milk or milk products the grade of which has been lowered by the health officer, and who is properly labeling his milk and milk products, may at any time make application for the regrading of his products.

Upon receipt of a satisfactory application, in case the lowered grade is the result of an excessive average bacterial plate count, direct microscopic count, reduction time, or cooling temperature, the health officer shall take further samples of the applicant's output, at a rate of not more than two samples per week. The health officer shall regrade the milk or milk products upward whenever the average of the last four sample results indicates the necessary quality, but not before the lapse of two weeks from the date of degrading.

In case the lowered grade of the applicant's product is due to a violation of an item of the specifications prescribed in section 7, other than average bacterial plate count, direct microscopic count, reduction time, or cooling temperature, the said application must be accompanied by a statement signed by the applicant to the effect that the violated item of the specifications has been conformed with. Within 1 week of the receipt of such an application and statement the health officer

shall make a reinspection of the applicant's establishment, and thereafter as many additional reinspections as he may deem necessary to assure himself that the applicant is again complying with the higher-grade requirements, and, in case the findings justify, shall regrade the milk or milk products upward, but not before the lapse of two weeks from the date of degrading.

Section 10. **Transferring or dipping milk; delivery containers; handling of more than one grade; delivery of milk at quarantined residences:**—Except as permitted in this section, no milk producer or distributor shall transfer milk or milk products from one container to another on the street, or in any vehicle or store, or in any place except a bottling or milk room especially used for that purpose. The sale of dip milk is hereby prohibited.

All pasteurized milk and milk products shall be placed in their final delivery containers in the plant in which they are pasteurized, and all raw milk and milk products sold for consumption in the raw state shall be placed in their final delivery containers at the farm at which they are produced. Milk and milk products sold in the distributor's containers in quantities less than 1 gallon shall be delivered in standard milk bottles or in single-service containers. It shall be unlawful for hotels, soda fountains, restaurants, groceries, and similar establishments to sell or serve any milk or milk products except in the original container in which it was received from the distributor or from a bulk container equipped with an approved dispensing device: *Provided*, That this requirement shall not apply to cream consumed or the premises, which may be served from the original bottle or from a dispenser approved for such service.

It shall be unlawful for any hotel, soda fountain, restaurant, grocery, or similar establishment to sell or

serve any milk or milk products which have not been maintained, while in its possession, at a temperature of 50° F., or less.

No milk or milk products shall be permitted to come in contact with equipment with which a lower grade of milk or milk product has been in contact unless such equipment has first been thoroughly cleaned and subjected to bactericidal treatment.

Bottled milk or milk products, if stored in water, shall be so stored that the tops of the bottles will not be submerged.

It shall be the duty of all persons to whom milk or milk products are delivered to clean thoroughly the containers in which such milk or milk products are delivered before returning such containers. Apparatus, containers, equipment, and utensils used in the handling, storage, processing, or transporting of milk or milk products shall not be used for any other purpose without the permission of the health officer.

The delivery of milk or milk products to and the collection of milk or milk-products containers from residences in which cases of communciable disease transmissible through milk supplies shall be subject to the special requirements of the health officer.

Section 11. Milk and milk products from points beyond the limits of routine inspection of the city of ____________________:—Milk and milk products from points beyond the limits of routine inspection of the city of________________may not be sold in the city of________________, or its police jurisdiction, unless produced and/or pasteurized under provisions equivalent to the requirements of this ordinance; provided that the health officer shall satisfy himself that the health officer having jurisdiction over the production and processing is properly enforcing such provisions.

Section 12. Future dairies and milk plants:—All dairies and milk plants from which milk or milk products are supplied to the city of............................... which are hereafter constructed, reconstructed, or extensively altered shall conform in their construction to the requirements of this ordinance for grade A dairy farms producing milk for consumption in the raw state, or for grade A pasteurization plants, respectively: *Provided,* That the requirement of a two-room milk house shall be waived in the case of dairies the milk from which is to be pasteurized. Properly prepared plans for all dairies and milk plants which are hereafter constructed, reconstructed, or extensively altered shall be submitted to the health officer for approval before work is begun. In the case of milk plants signed approval shall be obtained from the health officer and/or the State health department.

Section 13. Notification of disease:—Notice shall be sent to the health officer immediately by any producer or distributor of milk or milk products upon whose dairy farm or in whose milk plant any infectious, contagious, or communicable disease occurs.

Section 14. Procedure when infection suspected:—When suspicion arises as to the possibility of transmission of infection from any person concerned with the handling of milk or milk products, the health officer is authorized to require any or all of the following measures: (1) the immediate exclusion of that person from milk handling, (2) the immediate exclusion of milk supply concerned from distribution and use, (3) adequate medical and bacteriological examination of the person, of his associates, and of his and their body discharges.

Section 15. Enforcement interpretation: — This ordinance shall be enforced by the health officer in accordance with the interpretation thereof contained in

the 1939 edition of the United States Public Health Service Milk Code, a certified copy of which shall be on file in the office of the.. of the City of..

Section 16. Penalty:—Any person who shall violate any of the provisions of this ordinance shall, upon conviction, be fined not more than ....dollars, or imprisoned not more than............ days, or both, in the discretion of the court. Each and every violation of the provisions of this ordinance will constitute a separate offense.

Section 17. Repeal and date of effect:—All ordinances and parts of ordinances in conflict with this ordinance are hereby repealed; and this ordinance shall be in full force and effect immediately upon its adoption and its publication, as provided by law.

Section 18. Unconstitutionality clause:—Should any section, paragraph, sentence, clause, or phrase of this ordinance be declared unconstitutional or invalid for any reason, the remainder of such ordinance shall not be affected thereby.

U. S. Public Health Service Standard Milk Ordinance and Code and Dairy Farm Inspection Form:—A study of the provisions of the ordinance recommended by the U. S. Health Service will show that supervision is made of milk beginning with the cow and including transportation to the consumer.

Briefly the requirements may be summarized as follows: (1) healthy cows, well groomed, (2) properly constructed barns and milk houses, (3) approved equipment and utensils, (4) thorough washing and sterilizing of utensils, (5) prompt cooling of milk, (8) proper storage, and (7) adequate transportation facilities for milk.

While the score card is of value for ascertaining actual conditions on the dairy farm, it does not neces-

sarily evaluate the attitude and character of the dairyman. These are factors involved in the production of quality milk. Unless the producer is interested in producing good safe milk, proper equipment and utensils alone will not bring this about.

The inspector whose duty it is to supervise the sanitary provisions should also have a sympathetic understanding of the dairyman's problems. Increased consumption and enlarged markets are usually developed where dairymen and health agencies cooperate in providing the consumer with a high quality product.

DAIRY FARM INSPECTION FORM

Grade held..

No. of cows milking..

Total No. of cows kept...

Milking time........................A.M..........................P.M.

Raw-to-plant milk delivered to...............................

GALLONS SOLD DAILY

	Retail	To Plant
Whole Milk - - - - -	....	....
Chocolate Milk - - -	....	....
Buttermilk - - - - -	....	....
Skim milk - - - - -	....	....
Cream - - - - - -	....	....
TOTAL - - - - -	....	....

NAME.................................. MANAGER..........................

LOCATION........ ....

SIR: An inspection of your dairy farm has this day been made and you are notified of the defects marked below with a cross (X). Violation of the same item on two successive inspections calls for immediate degrading.

Remarks: ....

....

Cows

Item No.*

(1) ( ) *Tuberculosis and other diseases.*—Tuberculin test annually except in modified accredited counties ( ), annual abortion test (†), certificates of both tests on file ( ), other tests as required ( ), no cows with extensive induration of udder ( ), no cows giving abnormal milk ( ).

Dairy Barn

(2) ( ) *Lighting, milking barn.*—Adequate light openings ( ), adequate artificial light evenly distributed ( ).

Item No.*

(3) ( ) *Air space and ventilation.*—Well ventilated ( ), no overcrowding ( ).

(4a) ( ) *Floor construction, milking barn.*—Floors and gutters concrete or other impervious and easily cleaned material ( ), in good repair ( ), properly graded ( ).

(4b) ( ) *Floor cleanliness, milking barn.*—No accumulations beyond one milking ( ), no horses, pigs, fowls, calves, etc. ( ), water under pressure ( ).

(5) ( ) *Walls and ceilings.*—Painted biennially or whitewashed annually or other satisfactory finish ( ), clean and in good repair ( ), ceiling tight if feedstuffs over ( ), feed-room partition dust-tight with door ( ), no feed stored in milking portion of barn ( ).

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*Item numbers correspond to item numbers for Grade A raw milk in 1939 edition of the Public Health Service Milk Ordinance and Code, to which please refer.

†Not required for milk to be pasteurized.

(6*a*) ( ) *Cow yard, grading and draining.*—Graded ( ), drained ( ), no pooled wastes ( ), drain from barn ( ).

(6*b*) ( ) *Cow yard, cleanliness.*—Clean, droppings and other wastes removed daily ( ), no swine ( ).

(7) ( ) *Manure disposal.*—Stored inaccessible to cows and, during fly season; (*a*) Spread upon fields, or (*b*) piled no more than 4 days and then spread, or (*c*) stored not more than 7 days in impervious bin or curbed platform and then spread, or (*d*) stored in tight, screened and trapped manure shed, or (*e*) fly breeding minimized by other approved methods ( ).

Milk House

(8*a*) ( ) *Floors.*—Smooth concrete or other impervious material ( ), graded to drain ( ), good repair ( ), curbed ( ).

Item No.*

(8*b*) ( ) *Walls and Ceilings.*—Smooth dressed lumber, sheet metal, or plaster board well painted with washable paint; hollow tile, cement blocks, bricks, concrete, or cement plaster ( ), surfaces and joints smooth ( ).

(8*c*) ( ) *Lighting and ventilation.*—Effective window area at least 10 percent of floor area ( ), adequate artificial lighting (see Code) ( ), adequate ventilation ( ), doors and windows closed during dusty weather ( ).

(8*d*) ( ) *Screening.*—All openings effectively screened ( ), screen doors open outward and self-closing, unless flies other-

wise kept out ( ), screens in good repair ( ).

(8e) ( ) *Miscellaneous requirements.*—Used for milk purposes only ( ), milk house operations not conducted elsewhere ( ), no opening into living quarters or stable ( ), water under pressure ( ), wastes properly disposed of ( ), processes partitioned (†), 2-compartment stationary wash vat, 3-compartment if chlorine used ( ), adequate water-heating facilities ( ).

(9) ( ) *Cleanliness and flies.*—Floors, walls, windows, shelves, tables, refrigerator, sink and other equipment clean ( ), no trash or unnecessary articles ( ), milk house free of flies ( ).

Toilet

(10) ( ) *Toilet.*—Conveniently located for all workers ( ), clean ( ), good repair ( ), conducted and operated according to Code ( ), no evidence of defecation or urination about premises ( ).

Water Supply

Item No.*
(11) ( ) *Water supply.*—Adequate ( ), no surface or cistern water unless approved ( ), safe, sanitary quality (see Code) ( ).

Utensils

(12) ( ) *Construction.*—Smooth, heavy-gauge material ( ), corrosion-proof surface ( ). no agate ware ( ), easily cleanable shape ( ), joints soldered flush ( ), good repair ( ), milk pails small-mouth design ( ), strainers equipped with ster-

ilized, single-service discs ( ), no rust ( ), no woven wire ( ).

(13) ( ) *Cleaning.*—Cleaned after each usage ( ), must look and feel clean ( ).

(14) ( ) *Bacterial treatment.*—Steam cabinet 170° F. for 15 minutes or 200° F. for 5 minutes, or immersed in standard chlorine for 2 minutes, or flow of standard chlorine for 5 minutes, or hot-air cabinet 180° F. for 20 minutes ( ), thermometer ( ).

(15) ( ) *Storage.*—Left in treating chamber until used or stored inverted in protected place in milk room or cabinet ( ), cotton discs in original package until used and properly stored ( ).
handling of surfaces to which milk is exposed.

Milking

(17) ( ) *Udders and teats.*—Washed and clean at time of milking ( ), standard chlorine solution used at time of milking ( ), abnormal milk excluded ( ).

(18) ( ) *Flanks*—Flanks, bellies, legs and tails free from visible dirt at time of milking ( ), brushing completed before milking begun ( ).

Item No.*
(19) ( ) *Milkers' hands.*—Clean ( ), rinsed in standard chlorine solution just before milking each cow ( ), dry while milking ( ), hand-washing facilities including soap, water, and individual clean towels convenient to milking barn ( ).

(20) ( ) *Clothing.*—Clean outer garments.

(21) ( ) *Milk stools.*—Clean, not padded ( ), stored above floor ( ).

(22) ( ) *Removal of milk.*—Immediate removal of milk to milk house or straining room ( ), no straining or pouring except in milk or straining room ( ).

(23) ( ) *Cooling.*—Retail raw milk cooled immediately after milking completed to 50° F. or less and so maintained until delivery to consumer; milk for pasteurization delivered to plant or cooled to 70° F. or less within 2 hours after completion of milking ( ).

Bottling and Capping

(24) ( ) *Equipment and operation.*—Combination bottle filler and capper ( ), no hand capping ( ), caps kept in sanitary tubes and properly stored ( ), first cap discarded ( ), full credit given if milk delivered in cans.

Employees

(25) ( ) *Personnel, health.*† — Required examinations and tests ( ), rejected persons not employed ( ), no person with infected wound or lesion ( ).

Miscellaneous

(26) ( ) *Vehicles.*—Clean ( ), permanent top and permanent or roll-down sides and back; truck covered in case of milk for pasteurization ( ), no contaminating substances transported ( ), distributors' name shown (†).

Premises.—Surroundings kept neat and clean ( ).

Date ...., 194.....

Person Interviewed..

By..

City, County Inspector.

Wholesale Marketing of Fluid Milk:—This method of marketing Grade A milk is fast gaining favor with dairymen. The demand for pasteurized milk, various processed products, and modern service have been determining factors in this trend. The wholesale milk producer should first secure permit from health department and then make sales arangements with the milk plant or with a local cooperative milk association. While doing this the price buying plan or contract and base system are usually explained to him. The new shipper should thoroughly understand these details.

Buying Plans:—There are three types of buying plans used on southern milk sheds viz: flat-rate, base surplus, and usage or classification plan. A combination of these plans may also be used.

The flat-rate plan is simple. To illustrate, a milk dealer agrees to pay, for example, 30 cents per gallon for total production of a producer. This plan is found to be satisfactory in markets where production and consumption are fairly well balanced.

When there is a wide fluctuation in production, such as high production during summer months and low production during fall months, the base and surplus plan is used. Bases or quotas are of value in equalizing production and in supplying the market during fall months when demand for milk is usually the greatest.

While there are several methods of setting up or making bases, the average production for fall months —October, November, and December—is usually used for this purpose. This may be illustrated as follows: a dairyman ships 10,000 pounds in October, 12,000 pounds in November, and 14,000 pounds in December. His base for the following year would be 12,000 pounds per month—the average for the three base months. In cases where production exceeds this base or allotment, the price for the excess amount is lower.

The classification or usage plan appears to be gaining popularity as a basis for buying milk. The classification plan is based on the revenue received by distribution from the consumers of all milk and dairy products. In other words, milk is paid for on the basis for which it is sold. For instance, a dealer may find at the end of the month that 70 per cent of the milk he handled was bottle sales (retail and wholesale) 10 percent cream sales and 20 percent dairy by-products, such as ice cream mix and cottage cheese. It is reasonable to assume that the revenue from the sales of the latter 20 percent—for dairy by-products—was less per unit than the bottle sales unit for this portion of the milk.

In order to take the "guess" out of a dealer's business, classifications are set up on markets. A typical classification is as follows:

Class I—All fluid milk and cream sold in bottles (wholesale and retail) including chocolate milk, whole lactic buttermilk and other flavored milk drinks.

Class II—All milk and cream used for ice cream manufacture and condensed milk.

Class III—All milk in excess of Class I and Class II used in buttermaking.

Different markets use various classifications but the plans are usually similar. Under the above classification, Class I would receive the greatest volume and highest price. Class II would be the next highest price, and Class III a lower price than Class II. This price may be arrived at on a formula based on the Chicago butter market.

While the classification plan appears complicated, it is generally recognized as equitable where it is carried out honestly by the buyer. In reality, the producer consigns his milk to the distributor to sell at the best advantage.

Butterfat Differential:—Four percent is usually considered the average butterfat standard in the South; and, for the purpose of establishing equity between milk of high and low fat percentage, four percent is generally used. For instance, if four percent milk is worth $3.00 per hundred and a fat differential of 4 cents per 0.1% is used, 4.1 percent milk would bring $3.04 and 3.9 percent milk would bring $2.96.

If a dairyman wholesales his milk, he is relieved of the heavy investment and sales problems of retail delivery. All dairymen are not good salesmen. Many find it difficult to supervise the production on the farm and

Fig. 128. Cooperative Creamery. The late L. M. Sheffer, State Supervisor of Agricultural Education for Georgia, played an important part in establishing the Athens Cooperative Creamery, Athens, Ga. He was president of this cooperative at the time of his death. Usually, a farmer receives a larger share of the consumer's dollar if he markets his milk through a farmer-owned and operated cooperative marketing association than through a wholesale dealer. *This is especially true if the cooperative is properly managed.*

the business of retail delivery and collections. The gross returns for a dairyman who wholesales his milk are not as large as those received by the retail dairyman or more properly called producer-distributor. There may be but little difference in the net returns of the two.

Retail Marketing of Fluid Milk:—During the early days in the development of our first towns and cities milk was supplied by the family cow. Later families producing surplus milk began selling it to their neighbors; hence the beginning of the producer-distributor. This type of marketing, in the past, proved very satisfactory with a large number of successful dairymen, especially where the farm family took part in the dairy project.

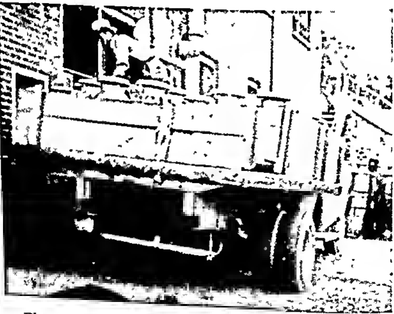


Fig. 129. Collecting Milk. In many parts of the South trucks travel through the rural areas and collect fluid milk from farmers with good herds and bring it to plants for the manufacture of various dairy products, including butter, cream, cheese, and ice cream.

In recent years milk distribution has developed into a highly competitive business and the trend for dairymen is toward wholesale marketing of milk The demand for pasteurization of milk by health authorities has also helped to bring this about In many instances producer-distributors have established plants and have offered a wholesale market to dairymen of their community.

In some milk sheds retail dairymen have formed associations and have developed cooperative distributing plants Reports of The Farm Credit Administration show that the number of associations is growing, and that they have made progress in volume of sales and financial strength Where these organizations have been established with proper management and producer support, they have been most efficient in marketing the milk of their members Table 40 shows an example of how a successful cooperative has developed in the South

TABLE 40—GROWTH OF A DAIRY COOPERATIVE DISTRIBUTING PLANT IN THE SOUTH

Year	Volume of Business	Lbs of Milk Handled	Average Price per Cwt
1931	$ 75,641 13	1,393,788	$2 34
1932	114,891 91	1,982,690	2 38
1933	113,080 10	1,956,164	2 25
1934	172,053 47	2,367,011	2 60
1935	179,670 84	2,415,017	2 85
1936	197,169 05	2 379,451	3 05
1937	239,409 95	2 458,890	3 25
1938	241,430 92	2,926,349	3 14

Collective Bargaining—Cooperatives:—This type of marketing agency does not usually assume the physical handling of milk The collective bargaining association acts as sales or bargaining agent for the membership with the distributor. Several of these organizations

are in existence in the Southern states. They have assisted producers in the securing of more satisfactory prices and price plans.

These associations have also assisted in market stabilization and elimination of unfair trade practices.

Selling Cream for Buttermaking:—Farm buttermaking was the foundation of commercial dairying in

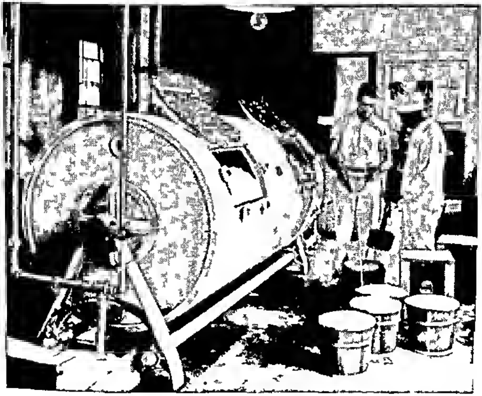
Courtesy Ext. Ser. U. S. D. A.

Fig. 130. Delivering Milk. Here is shown milk being delivered to the Wells Dairy Cooperative, Muskogee County, Georgia.

the Southern States. The introduction of the cream separator was the contributing factor in this development. Country butter was sold in towns and cities to regular customers and the excess production was sold for packing stock. The quality of this product was not uniform,

and with the advent of local buttermaking plants which made a more standardized product, country butter lost favor with the consuming public. However, there is still much butter made on farms and marketed.

Since the development of improved roads and trucks, cream routes have been developed in many sections throughout the South. This type of market has made satisfactory development in some communities. It gives



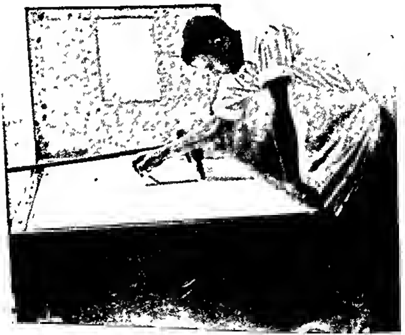
Courtesy Ext. Ser U. S. D A

FIG 131. A County Creamery. The butter is being removed from the churn of the Wilkes County (Georgia) Creamery. Many such creameries have proved successful in the South.

a monthly income from cream checks and the skim milk is utilized for feeding purposes to calves, poultry and pigs. However, the handling of cream involves extra labor on the farm wife, and on farms where hot water for washing utensils and cold water for cooling milk and cream are not available, cream production has not de-

veloped on a satisfactory basis. Lack of proper facilities has no doubt contributed to poor quality cream and to low prices for butterfat in some sections of the South.

Some cream producers have shifted to the production of market milk, others to sweet cream for ice cream making and still others to milk for manufacturing purposes. Cream for buttermaking proves most successful when the skim milk is utilized efficiently for feeding purposes. The rule ordinarily used for determining its value is as follows: 100 pounds of skim milk is worth



Courtesy Ext. Ser. U. S. D. A.

Fig. 132. Making Cheese. This picture was made at the Wells Dairy Cooperative, Muscogee County, Georgia. The operator is determining the temperature of the milk which is forming into curd. After the curd is set it will be cut into cubes with curd knives. After the whey is removed from the curd, it is pressed into cakes and then placed in curing room.

½ bushel of corn, or if corn is worth 80 cents a bushel, 100 pounds of skim milk is worth 40 cents. However, this product appears to have more feeding value than this rule or its chemical analysis indicates. Consequently, skim milk is not always fully appreciated by dairy farmers and often not economically utilized.

Selling Milk for Manufactured Dairy Products:— This type of market bids fair to be more acceptable to

Courtesy N. C. College Ext. Ser.

Fig. 133. Cheese Curing Room. The manufacture of delicious cheese is one of the important branches of the dairy business.

dairy farmers. The sanitary regulations are not exacting for this grade of milk and handling on the farm is simplified. Nearly all farmers can milk a few cows and set milk at roadside for truck pick-up. The products made from this grade of milk are ice cream mix, condensed milk, cheese, and dried milk powder.

Several large dairy concerns have located plants in the Southern states. The volume of business they have built up has justified the establishing of these plants. Future plants will be located as soon as sufficient volume can be found. This market will fit in with diversified agriculture and will offer Southern farmers another source of income so badly needed.

SUGGESTIONS FOR STUDY

A. Questions and Problems

1. What market information should one have befor starting a dairy enterprise?
2. What are the essential requirements of the Standard Ordinance?
3. What are the advantages and disadvantages of retailing and wholesaling of milk?
4. Do you have a cooperative dairy marketing association in your community?

B. Activities

1. Try to arrange with local health officer or milk inspector for a field trip to several local Grade A dairy farms.

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Chapter XVII

COMMON DISEASES AND PARASITES OF DAIRY CATTLE

Every dairy farmer and herdsman has to take care of sick animals at various times. Dairy cattle are subject to a number of diseases and parasites. Many of these call for the services of a veterinarian. The herdsman, however, should have a knowledge of first aid treatment, general care of sick animals, treatment for minor ailments, and the methods of prevention of diseases in general.

Cleanliness and Use of Disinfectants:—Dairy barns, where high quality milk is produced, must have impervious floors and be kept clean. This is necessary for one reason, to meet sanitary regulations of the health department. Floors of other buildings where cattle are kept, especially calves, may be similarly constructed. Dirt floors are difficult to clean and disinfect.

In the prevention of diseases or the control of them, the job of thoroughly cleaning and disinfecting the barns, sheds and yards is of first importance. To begin with all manure, bedding and refuse of any kind should be removed or put where cattle do not have access to it. The next job is to clean the buildings. If the barns and sheds have cement floors and the lower parts of the walls are cement, or similar material, it is an easy matter to thoroughly wash them. A two percent solution of ordinary lye (caustic soda or sodium hydroxide) makes a good cleaning solution, either on cement or wood structures.

The use of a disinfectant to destroy disease bacteria is the final part of the job. This is much easier if thorough cleaning has been done. Some organisms are more

resistant than others. A disinfecting agent of the proper type and strength should be used to do a complete job. Quicklime is effective in places that it will reach and where it can be used. Coal-tar or creosote disinfectants are satisfactory in places other than in the dairy barn or milk house where the odor would be absorbed by milk. A very universally used disinfecting agent is saponified cresol, which is a commercial product. It is effective, but like other coal-tar products, cannot be used where the odor could be taken up by milk.

Chloride of lime (chlorinated lime) is effective and can be used in dairy barns, if there is no organic matter for it to combine with. Solutions of chlorine, the same as used for sterilizing dairy utensils, can be used in the dairy barn and milk house on clean surfaces. These chlorine solutions are also effective deodorants.

It is essential to keep stalls and other parts of the barn clean and disinfected for the control of infectious diseases. This applies especially to isolation stalls, maternity stalls and calf stalls.

Isolation:—Whenever any new animals are brought to the farm they should be isolated from the herd. If obtained in the summer time, they may be placed in a separate pasture lot; but if stabled, they should be so handled that they will not come into contact with the other animals for a period of time necessary to get retests on them in keeping with the requirements of the State Department of Agriculture.

When any animal in a herd becomes sick it should be taken away from the other cattle. This will safeguard the other animals and have the sick one where it will not be molested by the others.

Common Diseases of Dairy Cattle

Calf Scours:—Common calf scours, usually caused by indigestion, is one of the most common troubles that occur in the dairy herd. It is usually caused by (1)

feeding from dirty pails, (2) feeding milk at varying temperatures, (3) overfeeding, (4) feeding very high test milk, or (5) keeping the calf in an unclean stall.

The milk for a calf with scours, should be reduced to one-half or two-thirds of the usual amount and the calf given a dose of one to two ounces of castor oil. A half pint of lime water may be added to the milk, or four or five drops of formaldehyde to each pint of milk fed the calf. In persistent cases, the calf should be given daily a teaspoonful of equal parts of salol and bismuth subnitrate. This may be given with the milk or placed directly into the mouth. In severe cases, anti-calf scour serum may be injected into the calf. Veterinarians usually have this serum available.

Young calves will usually keep clean and dry if the floors of the stalls are provided with wire frames, which are kept well bedded. This allows all the liquid excrement to drain through below the bedding.

Another means of reducing calf ailments is the use of a nipple pail for feeding milk. There are indications that when a pail fed calf gulps its milk down quickly, that the milk goes to the rumen instead of the true stomach, in which case, it may remain there and sour and cause indigestion. To avoid this, a nipple pail can be used whereby the calf sucks the milk from a rubber nipple placed in an opening cut in the lower part of the pail. This insures slow consumption and is an aid in reducing the amount of scouring in calves, especially in young or weak calves.

White Scours:—The disease—white scours—is contagious and produces a high mortality. Complete disinfection should be carried out to keep it from spreading. Serum and bacterins may be given by the veterinarian, especially to valuable calves. Sulfaquanidine, one of the new sulfa drugs, may be used to control scours.

Calf Pneumonia:—Pens that are cold, damp and poorly ventilated predispose the calf to pneumonia. A calf weakened by scours is also more susceptible. The calf becomes weak and shows loss of appetite, breathes with difficulty and coughs. A calf with pneumonia should be placed in a warm dry place and given a light purgative. Sulfa drugs or penicillin may be used in severe cases.

Ring Worm:—Ring worm, which is a skin disease, seldom appears in summer, but is prevalent where young stock are stabled in winter. It is caused by a fungus and may be transferred to man. The characteristic

Courtesy U. S. D. A.

Fig. 134. Pneumonia. This calf is affected with a form of pneumonia known as hemorrhagic septicemia.

form is round spots with rough scabs over them and the hair gone. These spots are more generally found around the head, neck and shoulders. It spreads rapidly from one animal to another.

The following treatment is most effective: The scabs should be washed with soap and water and scraped, and then tincture of iodine or an ointment, made of a mixture of an oil (sweet oil or castor oil) and sulphur should be applied to the affected areas.

Warts:—Warts may appear on various places on the bodies of animals. They often appear on the teats of milking cows. Some can be removed by applying a grease or oil, such as sweet oil or castor oil. If they are long with a small base they may be cut off. If this is done, iodine should be applied to the cut. Such warts may also be tied off with a silk thread or rubber band.

Blackleg:—In areas where there is any danger whatever from blackleg infection, the dairyman should have all calves vaccinated against blackleg before they go out to pasture.

Pink Eye:—Pink eye is an infection of the eye and will probably be contracted by a large number in the herd if affected animals are not quickly isolated. Animals of all ages are susceptible to it. The eyes become inflamed and water profusely. Some animals become temporarily blind, and in a few cases permanently. For treatment use yellow oxide of mercury or argyrol on the affected eye. Injection of a serum into blood stream may also be used. The lack of vitamin A in the ration may aggravate the condition. If this is indicated, especially in calves being fed a poor quality hay, an addition of vitamin A may be supplied by feeding daily, 20 cubic centimeters (cc) of cod liver oil or by feeding a carotene concentrate.

Bloat:—The excessive accumulation of gases in the rumen is called bloat. The rumen may become so filled that it distends the upper left flank. The animal may show pain and difficulty in breathing. One of the most prevalent causes of bloat is the eating of large amounts of such feeds as green alfalfa or clover when the cattle

have not been accustomed to eating it. Filling cows with hay or some other feed before turning on alfalfa, clover or similar pastures will aid as a preventive. They should, also, be watched at first, and allowed to remain on the pasture for only a short time.

In mild cases, a purgative (epsom salts or linseed oil) may be sufficient. If the distention is very great, some of the gas may be worked out by having the animal stand with its front feet higher than its hind feet, and with a wooden bit in its mouth. This may cause it to expel some of the gas by belching.

Some remedies that may be used to prevent further fermentation of the material in the rumen are: (1) two ounces of turpentine in a quart of milk; (2) two ounces of kerosene in a quart of milk; or (3) one-half ounce of formalin in a quart of water. These remedies are given as a drench.

In drenching an animal a long-necked bottle should be used. A rubber drenching bottle is preferable. The head of the animal should not be raised too high. If the head is too high it may result in the medicine getting into the lungs.

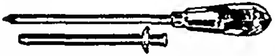


Fig. 135. Trocar and Cannula. To relieve severe cases of bloat, a trocar and cannula are forced through the skin and the rumen wall at a point between the hip bone and the last rib. The trocar is removed, but the cannula is left in place until the gas pressure is relieved.

In severe cases of bloat, it is sometimes necessary to puncture the rumen to let the gas out. A trocar and cannula are forced through the skin and the rumen wall at a point between the hip bone and the last rib. The cannula is left in place as long as gas escapes. If the pressure becomes great and a trocar is not available, an ordinary pocket knife can be used, but is not as

satisfactory. If the pressure becomes too great the animal will die from the pressure on the heart and lungs.

Milk Fever:—High producing cows are most snsceptible to milk fever. It usually occurs withiu the first day or two following calving. The cow affected will first show signs of staggering, then she will become paralyzed and will be unable to get up. She will lie with her head on oue side. It appears to be caused by the udder drawing from the blood stream, to make milk, certain constituents, mainly calcium and blood sugar, faster than the body can replace them. The injection of calcium gluconate will supply the needed calcium and is effective in curing milk fever. This is usually administered by a veterinarian.

Another treatment that was used exclusively before the discovery of calcium gluconate, is to pump air into each quarter of the udder until it is distended. This is effective in most cases and is still used when the calcium gluconate is uot available. Special milk fever outfits should be used. The milking tube used to insert into the teat openiug must be aterilized, and the teat cleaned off and disinfected to prevent udder infection. The air tube should contain a section that will hold some sterile cotton, through which the air is pumped. The eud of the teat should be tied with a cloth string to prevent the loss of air. There should be no attempt to drench a cow that has milk fever.

Prussic Acid Poisoning:—Some plants under adverse conditions contain prussic acid or hydrocyanic acid in amounts that are poisonous to cattle, and if eaten may kill them. Healthy, growing plants are seldom sources of the poison, but certain plants when stunted, especially by drought or frost, sometimes contain sufficient amounts to be dangerous.

Sudan grass, sorghum and Johnson grass are plants to be considered. If these crops are to be grazed follow-

ing adverse weather conditions, they should be tried out by using some animal that is not very valuable, before the herd is turned on to them. The cattle should also be given some other feed before they are turned on the crops. In case an animal becomes sick from these, a veterinarian should be summoned as soon as possible. The poison kills very quickly, but if reached in time, an injection of sodium thiosulphate and sodium nitrate may be effective.

Foul Foot:—This is an infectious disease that is spread largely through muddy barnyards. It starts as lameness from an infection between the hoofs and may affect the entire area around the hoof. Various treatments are effective if used in the early stages. The hoof should first be thoroughly cleaned. The animal should then be tied up and the affected foot should be placed in a tub containing a five percent solution of copper sulphate or a five percent solution of formaldehyde.

Other treatments consist of applying disinfectants such as cresol, coal-tar preparations or a commercial preparation to the infected foot. In severe cases, the foot should be bandaged to retain the application and to exclude dirt from the affected part.

At present the injection of sulfapyridine into the blood stream is being further investigated as a treatment for foul foot.

Cowpox:—Cowpox affects the udder and teats of the cow. Small blisters or lumps form on the udder and teats and produce a yellow pus. These blisters may dry up but if broken will form sores. The ones on the teats cause difficulty in milking.

The disease spreads from cow to cow, being carried largely by the milker. If the milker has not been vaccinated for smallpox, he may become infected, in which case he will develop immunity to smallpox.

To prevent the spread of cowpox, the affected cows should be milked last. As a further safeguard the hands of the milker should be washed in a disinfectant, such as chlorine, after milking each cow. A common treatment for cowpox is to rub the udder with carbolated vaseline or zinc ointment.

Tuberculosis:—At one time tuberculosis was found quite frequently in dairy cattle. The United States Department of Agriculture and the State Departments of Agriculture have cooperated since 1917 in testing cattle for this disease until now practically all the dairy cattle in all of the states have been tested. Less than one-half of one percent are now found to be affected with tuberculosis. Any that are found with the disease are slaughtered.

There are state and federal veterinarians who supervise the testing. The intradermal test is most generally used. Tuberculin is injected between layers of the skin at the base of the tail where it is free of hair. The formation of a lump at the point of injection within seventy-two hours indicates a reaction or an infected animal. The test must be made by a veterinarian.

Herds that pass two clean yearly tests or three clean semi-yearly tests are designated accredited herds free of turberculosis.

Bang's Disease:—Infectious abortion or Bang's disease shows up first by infected cows or heifers aborting premature calves. Retained afterbirths are prevalent in cows that have aborted. Because of not having milked the normal time and not having a rest or dry period. the cow does not produce well following abortions. Usually there are breeding difficulties with cattle that have aborted.

The organism causing the disease is spread from one animal to another, and usually several animals are infected before the disease is detected. There are some

Courtesy U. S. D. A.

Fig. 136. Vaccinating Against Bang's Disease. Veterinarians of the U. S. Department of Agriculture have developed a method of vaccinating calves that insures a certain degree of immunity against Bang's Disease. Here is shown a 7-months-old calf being vaccinated.

cases of abortion that are not contagious, which may be caused by injury, mineral deficiency, infection other than Bang's, or some other cause. For the protection of the herd, however, all cases should be regarded as contagious until the animal in question is shown to be negative to the blood test.

Cattle are tested for Bang's Disease by taking a small blood sample and testing it in a laboratory. The testing for Bang's Disease is under the supervision of State Veterinarians. Only animals that have passed two

Courtesy Ext. Ser. U. S. D. A.

Fig. 137. Bleeding for Bang's Test. This veterinarian is taking a blood sample from the cow to be tested for Bang's Disease.

or more clean tests should be brought into a herd. One of these tests should be made within thirty days of the date of bringing them into the herd. There has been considerable research work done on calfhood vaccination. It has proved very effective and is being used widely. Herds are accredited free of Bang's disease in a similar manner as for tuberculosis.

Mastitis:—Diseases of the udder are known by several names including mastitis, mammitis and garget. Bacterial infection of the udder causes the trouble. The bacteria enter through the teat canal and are generally transferred from one cow to another by the hands of

the milker or by milking machines. They may, however, be spread in other ways.

Isolating infected cows and milking them last should help to keep down the spread of the infection. Washing the hands or the teat cups of the milking machine in a mild disinfectant, after milking each cow, will help to lessen the spread to other cows.

The disease usually shows up as hard quarters, lumpy milk or bloody milk. The trouble may even pass detection. Milk from infected quarters has a high bacteria count. Some cases show up occasionally, which are caused by a lowered resistance to the organism, resulting from the cow lying on cold, damp ground, an injury to the udder, or other such causes.

Excessive protein feeding appears to cause cows to be less resistant to the mastitis organism. Very few cases of mastitis are permanently cured. Many times the disease destroys the milk secreting tissue and the quarter ceases to function.

The isolation of infected cows and the employment of sanitary measures seem to be the best means of controlling the disease. The strip cup (a pint or quart cup with a fine wire gauze or black cloth over it) is a simple device for checking the herd. To check on a cow, milk two or three streams of milk from each teat through the gauze and watch for any flakes that collect on it. All cases cannot be detected by this method.

Mastitis cards can be secured from dairy supply stores or veterinary supply houses. They have square pieces or crosses of blotter paper that have each corner impregnated with a chemical indicator, such as brom-thymol-blue, which changes color when milk from a mastitis quarter is milked on it. The first two or three streams are discarded in making the test.

The brom-thymol-blue tube test is more definite in detecting infection. It is made by adding one cubic cen-

timeter of the reagent to a test tube containing five cubic centimeters of freshly drawn milk. A green color reaction indicates the presence of mastitis. There are many other tests that may be used. The value of the use of these tests lies in the detection of cases before they can be found by the strip cup or by hand manipulation of the udder.

Many weak quarters are the result of mastitis infection. These can often be detected by the presence of hard spots or lumps in the udder tissue.

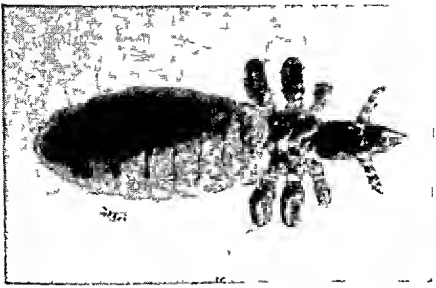
Sulfanilamide and sulfamethazine are being used with varying degrees of success. They are more effective in treating new cases than chronic cases. Penicillin appears to be effective in some cases but not in all. It is, however, being used quite widely for treatment.

The disease is of great economic importance both from the standpoint of the quality of milk produced and the effect on the producing ability of the cow. Some serums for the prevention of the disease, as well as for the cure of it, have been developed but they have not proved consistently effective.

Parasites of Cattle

Lice:—Lice are often found on calves, especially while they are housed during the winter. The hair gets rougher and the calves rub themselves a great deal. On examination the lice are most easily seen along the withers, brisket and fore flank.

Dipping is the most satisfactory method for ridding the calves of lice. This, of course, requires a dipping vat and cannot be done in cold weather. Nicotine dip (black leaf forty), coal-tar dips, and cresol dips are all effective for dipping or spraying. If there are any sores or breaks in the skin, the nicotine should not be used as the calf may absorb poison through them. Spraying on the dip with some kind of a pressure sprayer is effective; a knapsack sprayer is satisfac-



Courtesy Bureau of Etomology U. S. D A

Fig. 138. Long Nosed Louse. Dipping is the most satisfactory method of ridding calves of lice.

tory. The calf may be washed with the same solution as used for dipping or for spraying. This will prove effective if the animal is thoroughly covered.

If the weather will not allow any of the above treatments, the lice may be held in check by using rotenone powder and rubbing it into the hair well, especially around the neck, withers, fore and rear flanks.

A mixture of two parts mineral oil and one part kerosene is effective when put on with a sprayer and all parts are covered. This can be applied during most any kind of weather.

It is necessary to repeat the treatment in 15 or 16 days regardless of the kind of treatment used, to kill the lice that hatch after the first treatment.

With the discovery of DDT, the other methods mentioned above are largely giving away to its use. It may be used as a powder, a spray, or a dip.

Screw Worms:—Screw worms are more prevalent in the lower South than in the northern part of the region. The adult fly deposits eggs in flesh wounds.

Sores, cuts, and wounds from castration and dehorning are suitable places for laying the eggs. Also, new born calves may be attacked at the navel. The larvae attack the surrounding flesh. Chloroform or benzol poured into the wound will kill the screw worms. The pockets or wounds should then be cleaned out and an ointment containing a disinfectant or pine-tar oil should be applied to serve as a repellent and thus minimize reinfection.

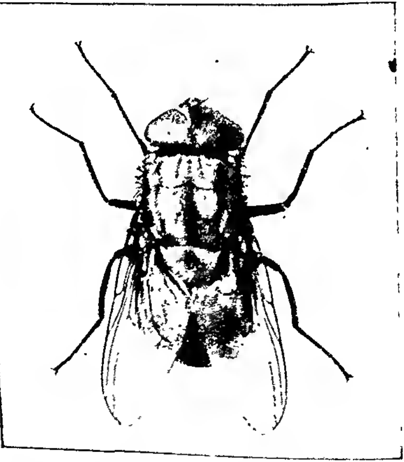


Fig. 139. A Screw Fly. It is about the size of the common house fly—bluish-green in back between the wings and with a yellowish-red face.

A more recently discovered compound that may be used instead of pinetar oil is diphenylamine. This powdered chemical sticks to the tissues of the wound for a few days, killing any worms that hatch during the time.

Ox Warble:—The ox warble does a great deal of damage to cattle. The fly (heel fly) lays its eggs on the legs of cattle. When these flies get among cattle the cattle become restless and run, almost to the extent of

Courtesy Ext. Ser U S. D A.

Fig 140 Treating Screw Worm Infected Cow. Diphenylamine, a powerful chemical, is a very effective substance to use. It sticks to the tissues of the wound for a few days—killing any worms or maggots that hatch during this time.

stampeding. The egg hatches and the larva burrows through the skin and gradually works its way, several months later, to the animal's back where it pupates just under the skin. Here it develops and is ready to emerge in late winter.

The most effective treatment is to use rotenone powder and rub it into the openings in the back when bumps appear. The rotenone can be applied as a spray if a heavy power sprayer is used that will force the liquid into the openings. The treatment must be repeated three or four times during the winter and spring.

Courtesy U. S. D. A.

Fig. 141. Dog Flies. In parts of the lower South, dog flies take a great deal of blood from cattle they attack.

Flies:—The stable fly and the horn fly are the ones that usually annoy cattle. The stable fly is very similar to the house fly, but has mouth parts that can bite the animals. The horn fly is smaller and usually gathers in numbers around the base of the horns of cattle.

Both types of flies lay their eggs mostly in manure and other refuse. The control was until recently in a large way based on the elimination of any such breeding places for the flies. They annoy cows and cause a lot of discomfort both to the cow and to the milker. Over many years, people everywhere have had to continually fight them without any real means of control. Dairymen used various oil sprays. Most of these were effective for only a few hours. Some sprays would at times gum up the hair of the cow. The control was unsatisfactory.

The discovery of DDT during World War II gave a method of control. Today, barns, milk houses, and cattle can be kept free of flies with little work and cost. Water soluble DDT powder is used. Oil soluble DDT cannot be used on animals because of the penetration of the oil into the skin, carrying the DDT with it. In Virginia two applications of 2.5 per cent DDT on barns will keep them fly-free all summer. In the deeper South where the fly season is longer, it may require three applications. This spray may be applied with a power sprayer or a barrel sprayer. A smaller sprayer such as the knapsack type can be used but will require more time.

The cows may be sprayed with the same strength solution, 2.5 per cent. The knapsack sprayer or the larger ones may be used. Usually three applications during the season are required, probably more in the deep South. The discovery of DDT and its use means a great deal to the farmer in terms of money, satisfaction, health, and comfort.

SUGGESTIONS FOR STUDY

A. Questions and Problems

1. Why should barns be disinfected?
2. How would you go about disinfecting a calf barn? Tell in detail.
3. Why should certain disinfectants not be used in a dairy barn?
4. How can you determine whether or not calves have lice?
5. What are the methods listed in this chapter for controlling lice?
6. How many times is it necessary to treat for lice? Why?
7. Why should you be careful in handling calves sffected with ring worm?
8. What would you do in case of severe bloat in a cow if you could not secure a veterinarian quickly?
9. What plants may cause prussic scid poisoning?
10. Why is mastitis of such great economic importance?

B. Activities

1. Secure a strip cup and some mastitis testing cards and test all cows in a nearby herd for mastitis. Also test the cows on your home farm.
2. Make arrangements with a veterinarian to accompany him when he is testing a herd for tuberculosis and bleeding it for Bang's.
3. Go to some dairy herd and examine calves for lice. If any are found, use one of the treatments described in this chapter.

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Chapter XVIII

FITTING AND SHOWING DAIRY CATTLE

Dairy cattle shows are for educational and advertising purposes. They afford individual breeders a splendid opportunity to show their herds in their "dress-up" clothes to the dairy public. The breeders as well as the breed associations use the shows as a splendid means of interesting new breeders in their breed. Educational agencies present, at the shows, improvements and advancements in the dairy industry. The shows also afford commercial concerns an opportunity to display the most up to date equipment, supplies, and other items.

In order for cattle to be placed on exhibit either at a show or at a public sale in an attractive way, they must be prepared. Animals that look good in their every day environment are not necessarily in condition to be exhibited at a fair. The amount of fitting that is justified depends on the number of shows to be made and whether they are local or larger shows. If animals are being prepared for sale, the amount of fitting will depend on the character of the sale.

Selecting Animals for Showing

The fitting will require a period of at least four to six weeks and preferably longer. Animals that are typical of the breed should be carefully selected. An off-type or inferior animal cannot be developed into a show ring winner. A good job of fitting requires considerable time and it should be spent on an animal that can be expected to make a creditable showing. The cattle selected for showing should be eligible for the individual classes as well as for the group classes.

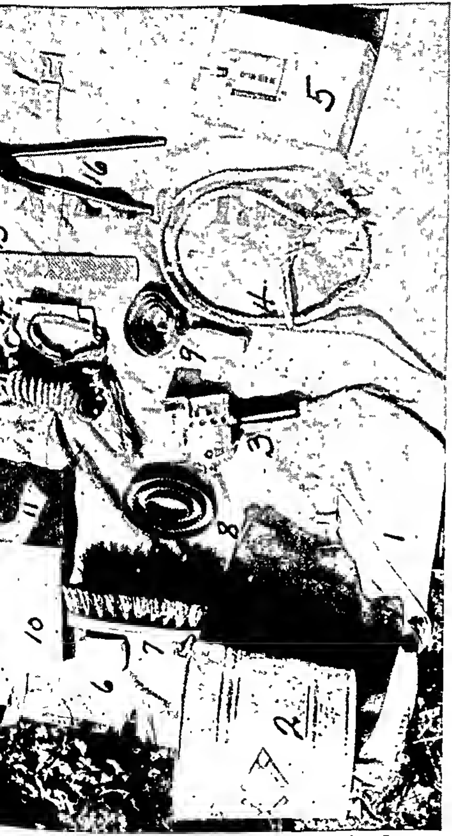

Fig. 142. Equipment for Fitting Animals.

1. Blanket
2. Pail
3. Clipper
4. Rope halter
5. Sweet oil
6. Soap
7. Fiber brush
8. Rubber curry comb
9. Steel curry comb
10. Sand paper
11. Piece of glass
12. Emery cloth
13. Cow lead
14. Horn trainer
15. Hoof and horn rasp
16. Hoof nippers

In the younger classes, especially, the age should be considered since the animal born just after the base date will have the advantage in size and development, and will show to better advantage. The base dates for determining ages are July 1st and January 1st for practically all shows. A group of 14 to 16 head will allow for filling most of the classes.

The Show Classifications

Female Classes:—

1. Heifer calf—4 months and under 1 year.
2. Junior yearling—1 year and under 18 months.
3. Senior yearling—18 months and under 2 years.
4. Two-year-old*—2 years and under 3 years.
5. Three-year-old—3 years and under 4 years.
6. Four-year-old—4 years and under 5 years.
7. Aged cow—5 years old and over.
8. Senoir champion cow—First prize winners in the 2-year-old, 3-year-old, 4-year-old, and aged cow classes competing.
9. Junior champion heifer—First prize winners in the calf, junior yearling, and senior yearling classes competing.
10. Grand champion female—Senior champion cow and junior champion heifer competing.

Bull Classes:—The bull classes are identical to the female classes, except the bulls four years old and older go in the aged bull class.

The championship classes for bulls also correspond with the female classes.

The Group Classes:—

11. Get of Sire—Four animals sired by the same bull, any age, not more than two to be bulls. Not necessary to be owned by exhibitor.

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*Any yearling heifer in milk must be shown in the two-year-old class.

12. Produce of Dam—Two animals any age, either sex, the offspring of one cow. Not necessary to be owned by exhibitor.
13. Dairy Herd—Four cows in milk, or close to freshening with udder distended.

Other Group Classes that Some Shows List:—

14. Exhibitors' Herd—
    1 bull 2 years old or older
    1 cow 3 years or older
    1 cow 2 years old
    1 yearling heifer
    1 heifer calf
    (all females to be bred by exhibitor).
15. Breeders' Young Herd—
    1 bull under 2 years
    2 yearling heifers
    2 heifer calves
    (all females to be bred by exhibitor).
16. Calf Herd—
    1 bull calf
    2 heifer calves
    (all bred by exhibitor).

In some cases it is wise to select and fit more animals than will be shown. Some will respond better than others and the decision on which ones to exhibit can be left until it is definitely known how they show up.

Stabling:—When fitting starts, the herd to be shown should be stabled all the time except for an hour or so in the cool part of the day when they should be turned out for exercise. After the animals are handled a great deal each day for training, this will suffice for exercise. The barn or shed for housing the cattle should be kept free of flies. The animals will be quieter if the barn in which they are kept is partially dark. If possible, the cattle being fitted should be tied close together

Fig. 143. Ready for the Show. These animals, fitted by students, are ready for the show ring. They have been properly fed, groomed and finished. They are ready to be shown in a sportsmanlike manner.

in one place. This makes caring for them easier and gets them accustomed to being handled in this way before they go to the show. Heavy bedding will help to keep them clean.

Feeding:—The job of feeding is to get the animals in good flesh but not fat. The breed associations are instructing judges to discriminate against over-fat animals. Most animals show stronger when carrying a fair amount of flesh; however, they should not become coarse and patchy. Every effort should be made to have the animals in a smooth condition with a distinct dairy conformation, rather than over-fat and beefy.

The animals should be placed on the fitting ration gradually. They will respond best if they have been on good pasture for two months or more before the fitting begins. This tends to get them in condition to handle more feed if necessary to get them in proper flesh; it also gives an opportunity for increasing their storage of vitamins and minerals.

Roughages:—Mixed clover and grass hay is very desirable for a part of the roughage. It is a good roughage to give "fill" and develop the middle. Straight legume hay may tend to be too laxative when fed along with succulent feeds and fitting mixture. Also, mixed hay is usually available on the show circuit when other hays may not be.

Beet pulp is the standard succulent feed for fitting and is available on the circuit. Silage, however, may well be used in the first part of the fitting period. If it is used there should be a change to beet pulp a week or ten days before leaving for the first show, so that the feed will not have to be changed while at the show. Beet pulp should be fed wet. It should be soaked for 12 hours in three or four times its weight in water. It stimulates appetite, and helps to develop the middle and will tend to keep the digestive system in good condition. Molasses may be fed with the pulp by adding two pounds to ten gallons of the water used for soaking beet pulp. Should the molasses cause looseness of the bowels, it can be reduced or discontinued.

The usual feeding of the soaked beet pulp is 10 to 20 pounds daily depending on the size of the animal. Feeding three times a day will cause the animals to put on flesh faster, since they will eat more than when fed twice a day.

Grain Feeding:—The feeding of grain should be watched carefully, to see that the animals are not over-fed and thus go off feed. Pushing an animal too fast will result in setting it back in condition. The grain mixture is best fed on or mixed with the soaked beet pulp. A simple mixture can be made by using the following formula:

Ground corn or barley	300 pounds
Ground oats	300 pounds
Wheat bran	300 pounds
Linseed meal	100 pounds
Salt	10 pounds

If the hay being fed is not of good quality or if the hide and hair of the animal is very coarse, the linseed meal should be increased. Also, if some other feeds are on hand, one or more additional kinds of feed will give more variety. When a simple mixture of standard feeds

is used, it is easier to obtain the feeds at the shows and thus be able to keep the show herd on the same feed used before leaving home.

The amounts of feed must be determined by the condition of the animal. After an animal has been put in condition, the grain should be limited to that amount necessary to maintain it and not let it get too fat.

With milking cows, care must be taken to prevent their milking down too thin. If they are too thin, they will show at a disadvantage. Cows and heifers that are heavy springers or have recently freshened will show

Fig. 144. Washing. An animal should be thoroughly washed to rid it of dirt and scurf. All the soap should be rinsed off to keep the hair from being harsh and stiff.

more bloom than cows that have calved several months previous. If a long circuit is made the cows will, of course, be in various stages of lactation.

Watering:—After the animals are tied up they may be led to water twice a day. This will give an opportunity to train them just that much more. During the last two weeks of fitting they should be watered from a pail. This will cause them to become accustomed

to drinking from a pail, and they will not be apt to fail to drink at the fair barn when watered from a pail. This will also give an opportunity to determine the amount they get the night before the show so that the fill can be regulated.

Washing:—One of the first things to be done in preparing animals for the show ring is to wash them to get rid of dirt and scurf. If they are thoroughly cleaned and kept blanketed and groomed, they may not need washing all over again. This is especially true with Jerseys and Guernseys. With these breeds all the secretions should be left. Holsteins and Ayrshires are usually washed again a few days before they go into the show ring.

The washing should be done with a mild soap such as castile or ivory, and by brisk rubbing. The animals should then be completely rinsed to keep the hair from being harsh and stiff. In cold weather, warm water should be used; in moderate weather cold water will do. In either case, the animals should be thoroughly dried and blanketed. Walking the animals after washing will stimulate them and help to keep them from becoming chilled.

It is difficult to remove manure stains from the legs, belly and switch of animals. These parts may need several washings, especially if the animals have white markings. After a good soaking with soap lather, the parts of the animal being washed should be rinsed with water and one of the following should be used for further rinsing: four or five tablespoonfuls of ammonia in a gallon of water; a diluted chlorine solution (same as for sterilizing dairy utensils); or bluing water, made just a pale blue. These tend to bleach out the stain. This can be done during the fitting period and again just before the show day.

Blanketing:—Blankets should be put on animals after they are washed. This helps to keep the hair and hide clean and to get them in good condition. Ordinarily a single unlined burlap or duck blanket will

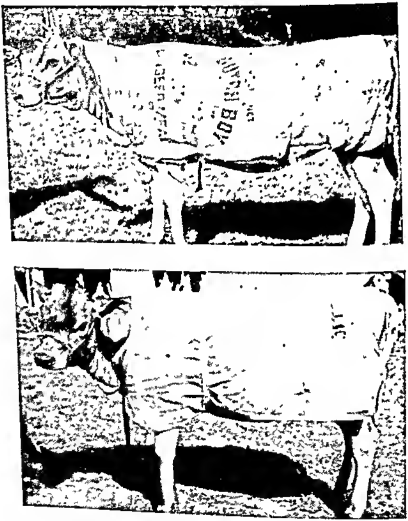


Fig. 145. Blanketing Animal. Blanketing is essential in getting the hair and hide of an animal in good condition. A homemade blanket, made from burlap bags and lined with cotton bags (shown at top) is a very satisfactory blanket for fitting. The ready-made blanket (shown at bottom) should be saved and used at the show or sale.

cause the hide and hair of animals to become soft and pliable during the time they are being fitted. Some animals, however, have long shaggy hair that is coarse, and a heavy hide. This condition can usually be taken care of by use of heavier blanketing. A lined blanket can be used or preferably a second or sweat blanket can be put under the regular one. This will keep the cow warm and speed up shedding of old hair and cause the other hair to become finer and to lie down.

Blankets may be purchased or satisfactory ones may be made from heavy burlap bags or other material and lined with flannel or other warm cloth. These home made blankets can be nsed during the fitting period and the purchased ones saved for the show. The material should be cut by a pattern so that the blanket will fit and can be kept in place on the cow or calf. The blankets will need to be washed at intervals.

In measuring for ordering blankets, only one measurement is needed. The distance from just in front of the withers to the pin bones should be used. For young stock, a few inches should be allowed for growth.

Grooming:—After an animal has been cleaned and blanketed, the next job is to brush her every day. A fiber brush and a rubber curry comb are the best tools. These bring out loose hair, dirt and dandruff, and work hand in hand with blanketing. This practice also stimulates circulation in the hide and in that way gets it in a more pliable condition.

To make the hide and hair more pliable and soft, an occasional light application of oil is valuable. Sweet oil may be used alone or can be mixed with either alcohol or glycerine or all three mixed together. The hair should not be made oily.

The parts of an animal that are not covered with the blanket need brushing the most. This is especially true of the legs and belly. Additional grooming

Fig. 146. Fitting the Feet. The toes should be cut off with hoof nippers. The hoof can be cut from the bottom with a hoof knife to make the foot set squarely under the animal.

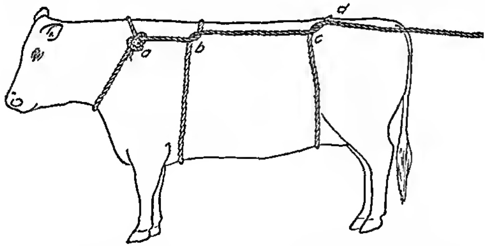
these parts must compensate for not being covered. The daily brushing, in addition to conditioning the animal, will get it used to handling and aids a great deal in training for the show ring.

Trimming the Feet:—Cattle that have been running loose for several months will usually have their hoofs worn down to normal size. They may need attention during the fitting period while they are being kept up. Some may have come into the fitting shed with uneven hoofs. An animal cannot stand to show herself off best if her feet are uneven or toes too long. Hoofs in this condition may throw an animal back on its heels and make the hind legs show sickle hocked or cause the front feet to turn out.

With young cattle and some cows, the feet may be held up to trim the hoofs; with bulls and some others it is usually necessary to throw them. They can be thrown without danger of injury to them as follows: tie the animal with a halter; fasten one end of a rope on

the horns or around the neck; make a half hitch around the body just back of the front legs and another just in front of the hind legs; then pull on the rope to the rear of the animal. As the rope tightens, the animal will go down. The legs may then be tied so that the feet can be worked on.

In trimming, the hoof should be cut from the bottom with a knife or hoof nippers and then finished with a rasp. A cow will not show any better than the condition of her feet. The trimming should be done early in the fitting period so that the training can be done on good feet and so she will learn to stand squarely and naturally. The outside of the hoof can be worked down and polished as directed for horns.



From Iowa Ext. Bul. 24

Fig. 146a. Throwing Cattle. For throwing cattle, the method shown here is simple and effective. A rope 35 or 40 feet long is needed. Place one end around the animal's neck and tie it with a bowline knot. Next, pass the rope around the animal's body just back of the forelegs, making a half hitch over the withers at b. Now pass the rope around the body at the hips, letting it draw up into the flanks. It is well to have the rope on one, side, as at c, in front of the hip bone, and the one on the other side, as at d, behind it. This prevents the rope from drawing too far ahead over the loin, and also from slipping too far back. In throwing a cow, care should be taken that the rope is entirely in front of the udder. To throw the animal, pull to the rear and toward the side upon which she is to be thrown. When the animal is down, turn the head to prevent her from rising.

Fig. 147. Fitting Horns. The horns should be smoothed with emery cloth prior to polishing.

Fitting the Horns:—The horns count only one point on the score card for most breeds and in some breeds a dehorned animal is not discriminated against. Jerseys, Guernseys and Ayrshires have usually been shown with horns. There is a trend toward more dehorning, even in registered herds. The new look is becoming popular. The training of horns must start when an animal is a calf. Weights fastened on the end of the horns will pull them down. Various kinds of trainers or pullers will curve the horns. As animals get older the horns are harder to change.

In fitting the horn, the rough part is worked down with a rasp and a piece of glass or other sharp tool. The scraping should get all rough places smoothed out. They should be scraped down to a refined size. With Jerseys and Guernseys, the white should be scraped off, if possible, to leave the dark or amber color. One should work

carefully so as not to go through into the quick and cause bleeding. Fine sandpaper or emery cloth will work horns down to a smooth finish.

A satisfactory polish can be obtained by using a paste made from a mixture of tripoli powder, sweet oil, and glycerine. It should be applied to the horns and rubbed with a flannel or wool cloth. The purpose in fitting the horns is to have them add to the general appearance of the head and not detract from it.

Clipping:—When the fitting period is sufficiently long to get the hair worked down in good condition, it is not advisable to clip animals all over. A fine quality hair will develop by blanketing and grooming rather than by clipping. Coarse hair will grow out after clipping. Animals that will not shed normally or those that must be fitted in a very short time, of necessity may

Courtesy Ext. Ser U. S. D A.

FIG. 148. Clipping Legs. The clipping of the legs and under parts of animals should be done two or three weeks before the show and then reclipped a day or two before the show day.

have to be clipped all over. This should be done two or three weeks before the show.

With normally fitted animals, the udder and belly should be clipped to show up the quality and veining. Sometimes the legs may need to be clipped. The hair on the bellies of heifers should not be clipped unless it is excessively long. If the hair is left, the animal will show somewhat more depth.

The clipping of the legs and under parts of animals should be done two or three weeks before the show and

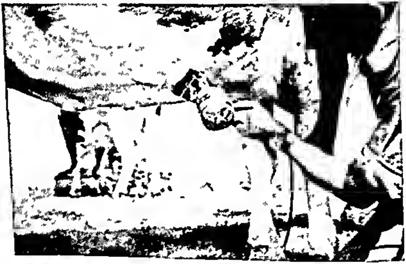


Fig. 149. Clipping Belly. Clipping the belly of a cow makes the veining stand out. The bellies of heifers and bulls are usually not clipped.

then reclipped a day or two before show day. The preliminary trimming gets the animal accustomed to the clippers and gives the fitter an opportunity to see how it shows up when clipped. Then if changes need to be made, the final clipping will take care of them.

Clipping is done to improve the general appearance of animals. After being clipped they will show more refinement, quality and cleancutness throughout. Usually

the entire head and neck are clipped. The dividing line between the clipped and unclipped portions run from the point of the shoulders to just in front of the withers. This is always the dividing line with bulls. Sometimes only the head and ears of females are clipped. In such cases, the clipped portion goes from the mouth to the eye, then to the ears and over the poll, including all in front of this line, and the area around the horns, which is trimmed neatly, and the ears, which are clipped all over.

Fig. 150. Clipping the Tail. In clipping the tail all of the switch should be left. One should clip from the switch to the tail head.

The tail is clipped from above the switch to the tail head. Not any of the switch should be clipped and one should not clip too high up on the tail head.

If the legs are clipped, a smooth job should be done. The clipping should stop at a point so a blend can be made without being noticeable. Udders of cows are always clip[illegible] to show up a finer quality than is possi-

ble with long hairs on them. The bellies of cows are clipped to allow the veining to be more prominent. The bellies of heifers and bulls are clipped if they are shaggy, otherwise they should be left unclipped so the hair will add to depth of body.

In all cases, an even job of clipping should be done. The clipped should be blended with the unclipped hair so that it will not be very noticeable. This job as well as

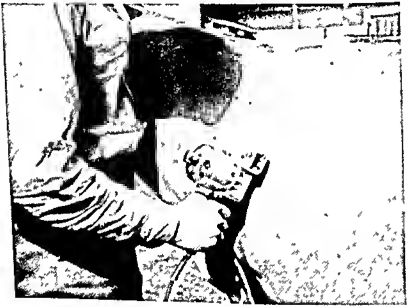


Fig. 151. Marking Dividing Line. Here is shown the job of marking the dividing line between the clipped and unclipped area. Note the tilt of the clipper blade to make the mark less noticeable.

many other parts of fitting is an art, and training and experience add to one's ability in turning out a natural appearing finish on an animal.

Training:—The training goes right along with the fitting. Both take time and practice. A little handling each day is more valuable than a lot of time spent irregularly. Tying the animals in the fitting shed or barn

will get them used to the halter. Handling them gently when feeding and grooming will teach them not to be afraid of the caretaker. If possible each animal should be led daily. After an animal will lead well, it should be taught to walk slowly and to change its gait at the will of the leader. An animal walking slowly will stop in a better position than when walking fast. With sufficient training, the animal will respond to the leader by certain movements of the halter and by pressure of the hand on the animal.

An animal should be trained to move a step or two back. In the ring one should not count on having to back an animal into place; other means of getting it in position should be used. When standing, the feet of an animal should be squarely under the body but not entirely even with each other. One hind foot should be slightly advanced. The animal should be trained to move one foot without moving the others. This may be done by training an animal to respond to handling from the halter.

The halter should always be put on so that the lead is on the left side. As the training progresses one should study the faults of each of the animals. They should not be allowed to stand so that they show weaknesses they do not naturally have. In cases of some weaknesses, careful training and showing will lessen the appearance of them. This is true to some extent with slightly low backs or when the animal is a little low at the pin bones. The animals should be shown to strangers and handled by them. This will get them accustomed to strangers and they will not be so shy.

Transporting the Cattle:—If the shows are not too great a distance away, the cattle may best be transported by truck. When several shows are to be made at some distance, the cattle will stand travel by train bet-

ter than by truck. A large car should be secured, fitted up and kept for the entire circuit.

Freight cars and trucks should be disinfected. The same kinds of feeds should be fed regularly during travel and at the show as was used for fitting. The amount of grain fed should be cut in half in transit. The cattle should be watered on schedule. They may not drink well on account of change of water. If they have been used to eating and drinking from tubs and pails, there will be less change in their routine.

Fig. 152. Putting on the Finishing Touches. Just before an animal goes into the ring, it should be touched up so that fitting is as near perfect as possible.

At the Fair:—The job of the showman at the fair is two-fold, namely: (1) to make an attractive and creditable exhibit of his cattle in the barns, and (2) to show them in the ring in the best condition and in such manner as will allow them to appear to the best advantage.

In the barn, the animals should be lined up according to size. This makes them show more uniformity. One should have plenty of clean bedding and should keep it worked up even on a line so it will give a neat appearance. The cattle can be put back on full feed after their trip. Blankets are usually kept on animals most of the time to keep their hair in good condition, but they should be removed to let observers see them. Suitable signs should be placed over the cattle to let visitors know more about the individuals, such as name, age, pedigree, production record and show winnings, if any.

A day or two before show day is a busy time for the showman. He must get his cattle prepared. Stains may need to be washed from the legs and switch; final clippings with as smooth a job as possible may have to be done; halters and other equipment must be put in shape; the horns and hoofs may need to be smoothed; and many other things may need to be done to put a final finish on the animals and have them ready for the show ring.

The night before show day, a limited amount of water and hay should be given to the animals. To allow for a good fill the next day, some extra salt may be given. Cows should be milked out the night before show day. The next morning, one should milk out what is necessary to keep the udder and teats from strutting, but still show with a full udder. The night before the show, the switch should be washed and braided into several strands and then wrapped with narrow strips of cloth. It should be left like this until near show time. The cattle should be watched all night in order to keep them clean.

Show Day:—The animals should be cleaned and brushed thoroughly; finishing touches should be put on the horns; the switch should be taken down and combed

out fluffy. About an hour before show time, the cattle should be given additional beet pulp and water to get the desired fill. The amount of water should be regulated, as too much cold water will cause them to hump up and be loggy.

When the class is called, one should be ready and should lead into the ring showing the animal and never stop showing it. It should be handled so that its strong points are outstanding. The animal should be led slowly and brought into line. One should stop a few steps back and then bring the animal up in place and at the same time get its feet properly placed. If the animal gets too far ahead, it may be possible to back it a step or two, but it is usually wise to lead it around and come into position again. The animal should never be stopped with its front feet lower than its hind feet. The animal should be given a chance to win, but if it cannot win one should try to get it placed as far up as possible and above all, it should be shown in a sportsmanlike manner.

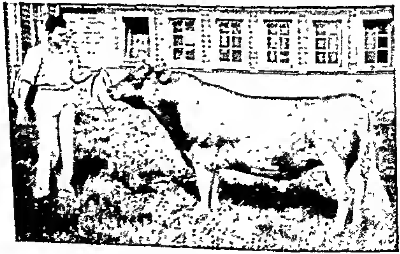


Fig. 153. The Job of Fitting Completed. This well-fitted and trained Guernsey bull is now ready for the show. Note how clean this bull is and the wave in his switch.

A good showman will use every possible opportunity at the fair to give visitors information about his herd. He can in this way advertise the herd and advance the popularity of the breed.

SUGGESTIONS FOR STUDY

A. Questions and Problems

1. What benefits are derived from showing dairy cattle?
2. What local shows do you have near you?
3. List the reasons for blanketing an animal when it is being fitted for show.
4. Why not clip dairy cattle all over?
5. Tell why the bellies of cows are clipped. Why are heifers usually not clipped?
6. How would you work down a horn and polish it?
7. If you should have to throw an animal, how would you go about it?
8. Which age class would a young bull be in that was born on August 2nd the year before he was shown?

B. Activities

1. If animals and equipment are available prepare the animals for a show or possibly a sale. The class as a whole may help a dairyman to fit some cattle. Possibly a show for juniors can be arranged where the boys will be judged on how well they have fitted their animals and the way they are shown.
2. Make a trip to a dairy show. Study the catalog for classifications and requirements. Observe

the way that the cattle have been fitted. Watch carefully how the showmen handle their animals in the ring.

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CHAPTER XIX

ARTIFICIAL INSEMINATION OF DAIRY CATTLE

Artificial insemination is one development of science that has only recently been applied in a practical way to improve the kind of dairy cattle raised for replacements. The method has been known to man for many years.

It has been reported that the Arabs as early as 1322 used artificial insemination. The method was used in Italy in 1780 in breeding dogs. It was first used in recent years on a mass scale in Denmark and Russia. Denmark organized the first cooperative artificial breeding association in 1936. This pioneer organization comprised 220 members with 1,070 cows. In three years the movement grew to 21 associations with five thousand members who owned twenty-three thousand cows.

E. J. Perry, Extension Dairyman for New Jersey, went to Denmark and made a study of the methods and kind of organization being used. After his return, he assumed the leadership for organizing in New Jersey in 1938 the first artificial breeding association in this country.

What Is Artificial Insemination?

Artifical insemination of cattle is the process of collecting semen from the bull by artificial means and then depositing some of the semen into the cervix or the uterus of the cow. The semen is the fluid ejaculated by the bull at time of service. It contains the sperm or the male reproductive cells.

The semen is usually collected by use of an artificial vagina. This is a long tube with a rubber liner and a

water jacket. The water jacket is used to keep the vagina at body temperature. As the bull mounts a cow or a dummy used for the purpose, he is guided to ejaculate into the artificial vagina. There are other methods of collecting semen.

The amount of semen collected at one time is usually from three to six cubic centemeters. On the average it contains from several hundred million to

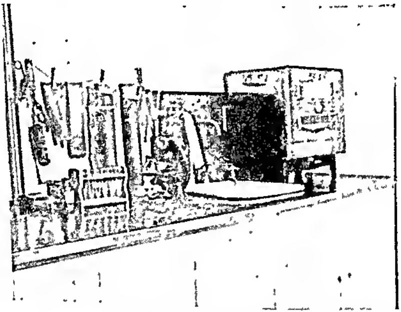

Fig. 154. Equipment for Collecting Semen. Here is shown all the equipment necessary for collecting the semen from the bull.

a billion sperm per cubic centemeter. For extensive use of the semen it is diluted from 4 to 10 times its volume with an egg yolk-buffer solution. At times it may be diluted to fifty times its volume. With the normal dilution, one service will furnish sufficient semen for 30 to 50 cows. With the higher dilution, of course, many more cows can be inseminated.

Before using the semen, the inseminator should always examine it under a microscope to see if there is a large number of active sperm.

In order to extend still further the use of the semen from good sires, research workers have perfected plans to hold the semen for several days for use. To preserve it, the temperature is decreased slowly to around 40°F. after the egg yolk-buffer solution has been added. It is kept at this temperature until used. In transit a thermos bottle is employed.

In organized associations, good semen is usually used for three days. It may be kept longer and used, but can be expected to deteriorate after the third or fourth day.

The insemination process consists of depositing one or two cubic centimeters of semen either just at the cervix or into the uterus of the cow. This is accomplished by using a glass tube 14 to 16 inches in length. A two cubic centimenter syringe is connected to it. Semen is then drawn through the tube into the syringe. The tube is inserted through the vagina of the cow to the cervix. The syringe then is used to discharge the semen.

Value of Artificial Insemination

This method of insemination of animals has had a great deal of publicity. Some of it has been developed on a sound educational basis; while some has been of a sensational nature. For example of the latter type, much publicity was given to the fact that semen was collected from a grand champion bull at the Pacific International Livestock Show on the West Coast, flown to the East Coast and used to inseminate cows at the New York World's Fair. Another widely publicised stunt was when semen was collected from a bull in Pennsylvania, shipped by plane to Australia

and used to inseminate cows there. Both cases were fruitful and calves were dropped from the service.

This method may be used to mate large bulls with small heifers. By artificial insemination it is also possible to use a valuable sire that due to injury or for other causes cannot easily breed a cow.

The real value of the artificial insemination method of breeding cows is to extend the use of outstanding sires. Bulls used artificially may be bred to several hundred or even a thousand or more cows in a year's time. When outstanding, proved bulls are selected on the basis of production of their daughters, type, general handling qualities, long life, and other desirable characters, the sire's influence in improving the dairy cattle in quite well assured.

Three or four well selected bulls may replace 40 to 50 poorly selected bulls used in about the same number and size of herds.

The small dairyman with a few cows and probably a non-descript herd sire is certainly at a disadvantage in building up his herd to a profitable level of milk production. If he can join an organized artificial breeding association, he can have the use of as good or better bulls as many of the large dairymen.

As compared with other programs for the improvement of dairy herds, it appears that artificial insemination offers the one best method of improving dairy cattle on a large scale.

Use of Disease Free Bulls

Bulls that are selected should be tested for all possible disease. This will prevent or lessen the spread of certain diseases. If the bull is free of all diseases that can be transmitted from cow to bull and from bull to cow by breeding, then there is no possibility of getting semen that is a carrier of infection. A bull used in an artificial breeding association should not

be used for natural service unless he is tested again for all possible infections.

The inseminator must use complete sanitary methods so there will be no carrying of disease from one cow to another cow.

Efficiency of Artificial Breeding

Natural breeding of cows in an average dairy herd usually requires from 1.6 to 2 services per conception. A few will be lower. If there is disease or other breed-

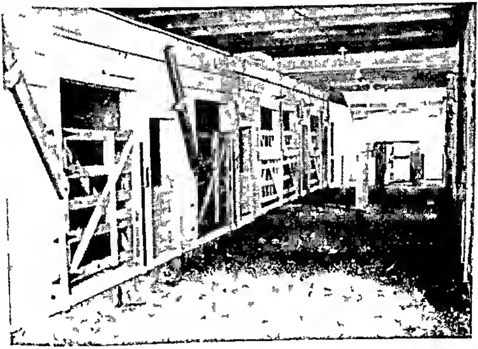

Fig. 155 The Bull Barn. This is the interior of a bull barn Note the stalls on both sides of the hall. The breeding rack for collecting semen is at the far end of barn hall

ing troubles, more services will be required. It has been found that artificial breeding gives just about the same rate of efficiency for settling the cows. This method cannot be expected to settle the majority of cows that were known to be hard or slow breeders when bred naturally.

Artificial Breeding Associations

The real value of artificial insemination is that it makes it possible to breed a large number of cows owned by many dairymen, including the man with a few cows, to a few well selected sires. To accomplish this, it is necessary that it be carried out through some organized group. In the majority of the present operating groups, it is set up on a cooperative basis with the dairymen being the members of the cooperative. In a limited number of cases an individual or corporation sets up the unit and sells the service to dairymen.

The Bull Stud

The unit of bulls should include three or more bulls of each breed used. They should be maintained at a central point. It is preferable not to collect from a bull oftener than once a week. Bull barns, lots and pastures should be such that the bulls can be properly cared for and handled without danger to the caretaker.

There must also be a laboratory at the unit with equipment for examining the semen and for diluting, preserving, and storing it. Complete sterilization equipment is essential.

Semen collected from a bull stud may be used for one inseminating association or for several associations. If more than one association is served, the semen is usually delivered by bus or by mail.

The Inseminating Association

The inseminating unit must for financial reasons include around 1,200 cows actually signed up and membership fees paid. These cows, almost of necessity, must be in an area of a 20 mile radius.

It is necessary for the association to employ a trained technician who is responsible for caring for the semen and for inseminating the cows. He gets the semen from the bull stud either direct or by shipment.

Each sample may be used two or three days The semen is kept in a refrigerator at 40° F or less Each morning it is examined to see that it is alive and active

Arrangements are made with the members of the association to notify the inseminator by a certain time (probably nine o'clock) on the morning that he has any cows in heat This is usually done by telephone

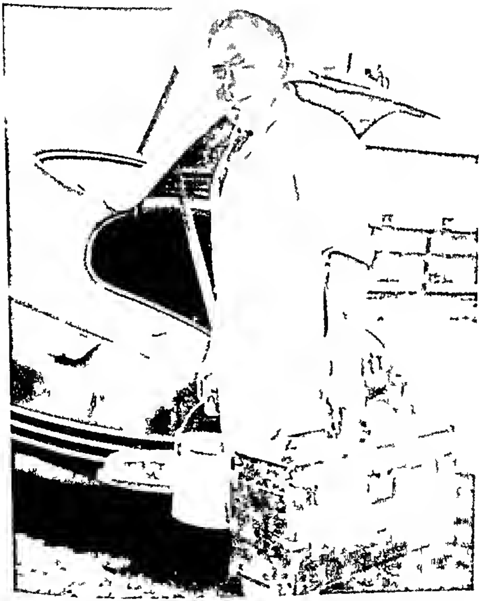

Fig 156 The Technician When the technician arrives at a farm he has with him the equipment and semen for inseminating the cows.

Other means may be used, but are not as satisfactory. Cows that come in heat in the afternoon are reported the next day.

With the orders in for the day the technician assembles the necessary equipment which has been sterilized. No equipment is used on more than one cow until it has been cleaned and sterilized. The semen is carried by the technician in a thermos jar.

The route is lined up to save travel and the technician goes on his way with billions of sperm, representing the connecting link between the bull and his calves. At the farm he inseminates the cows that are in heat—using sanitary precautions to prevent the spread of disease or injury to the cows. The animals are usually found in the stanchion or tied in a conveniently located stall. The technician can handle the insemination without help.

Cost of the Service

Usually it is not wise to promote an organization on the basis of low cost. However, the cost through artificial breeding associations is usually lower than the service of bulls of similar quality by natural breeding. The greater purpose and value is the opportunity to get the inheritance of superior blood lines into the herd. Then, too, there is a big advantage of not having to keep a bull. No bull is safe all the time. This danger is eliminated. Artificial breeding certainly saves a lot of time for a farmer who owns a small herd and breeds his cows to a neighbors bull.

There is no one figure that can be given for the cost. Each organization must work this out on the basis of its own conditions. Just what kind of bulls are used and whether they are purchased or leased will influence the cost. However, approximate costs based on some of the cooperative associations in Virginia

may be given. The following are approximate fees and assessments:

(1) Membership fee for each farmer (paid only once) $5.00
(2) Insemination fee for each cow 5.00
(as many as three services are allowed, if cow does not settle after the first or second service.)
(3) Additional services at the option of the owner at $2.00 per service.

These fees give the owner the use of proved or well selected bulls. Because of greater use, more valuable bulls can be had. The price does not always indicate the breeding value of a bull. Usually 60 per cent of the inseminating fee will pay the salary of the technician and maintain his equipment and laboratory. The other 40 per cent may then go toward maintaining and replacing the bulls. Such associations should be incorporated under the laws of the state so that responsibility is not on any one person.

The U. S. Bureau of Dairying reports that the number of herds and cows enrolled in artificial breeding associations increased more than 90% during 1946. In January, 1947 there were 1,125,040 cows in 140,571 herds being served through 608 organized associations. Some of these are in the South. More are being organized at present. The South needs the service. Dairy leaders in the South should use every opportunity to advance this movement which will in a few years result in higher quality dairy cattle in the Southern States.

Other programs of improvement have helped to advance the quality of dairy cattle, but nothing has been done as yet that promises to speed up production and improve herds as much as will the full development of artificial breeding associations.

SUGGESTIONS FOR STUDY

A. Questions and Problems

1. What is meant by artificial insemination? How long has this means of reproduction been known?
2. When and where was artificial insemination started in this country on a practical and extensive scale?
3. Why does this method of reproduction hold such great possibilities for improving dairy herds and increasing production of dairy cows?
4. Explain how an artificial breeding association may be formed and operated. How many cows are needed by the members to make an association function?
5. How efficient is artificial insemination of dairy cows?

B. Activities

1. Visit an artificial breeding association and study methods and procedures followed to make association function.
2. Request information from your proper agricultural college official regarding the extent of artificial breeding of dairy cattle in your state. Find out how many artificial breeding associations are in operation in your state—including the total number of members and number of cattle involved.

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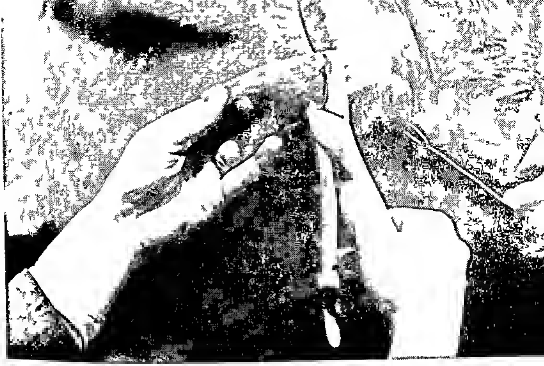
CHAPTER XX

PRODUCTION TESTING OF DAIRY CATTLE

The testing of cows for production of milk and butterfat dates back many years. It was only natural for owners of fine cattle to want to keep production records of their dairy cows. Early in the development of purebred cattle in this country, owners kept milk weights on some of their cows. These were private records and, of course, did not have the authentic backing that present day official tests or dairy herd improvement association records have. Realizing this the breed clubs established a system of having the tests supervised by a disinterested person called a tester or supervisor. Most of these tests were for a seven day period; some were conducted for thirty days and later for a whole year. For the shorter tests the supervisor remained on the farm and checked each milking. For the tests covering a year the owner weighed the milk each milking and the supervisor spent two days at the farm each month.

Some of these tests were made before the Babcock test was perfected in 1890. It was, therefore, the job of the supervisor not only to weigh the milk, but to keep each cow's milk separately and to churn it. The records were reported in terms of pounds of milk and pounds of butter (a pound of butter legally must contain not less than 80% butterfat). Soon after 1890 the Babcock test was designated as the official method for determining the record of a cow. Not until about 1928 did all the breed associations approve the system of recording the production in terms of milk and butterfat and discontinue the term butter.



Courtesy U S Bureau of Dairying

Fig. 157. Eartagging a Calf. Calves should be eartagged for permanent identification.

Dairy Herd Improvement Association

Another type of testing was developed in Denmark in 1895. The people of this small country were pioneers in many phases of cooperative farm improvement methods. Their system provided for the testing of all the cows in the herd month after month and year after year. Feed costs as well as production records were kept. They were based on the yield of milk and butterfat for one day each month. The monthly records were calculated on the yields of this one day. This system was brought to this country and the first association was organized in Michigan in 1905. The first one in the South was established in Virginia in 1907.

Purpose of Testing:—Cow testing associations grew in number and in scope. Later the name was changed to the Dairy Herd Improvement Association, usually called D.H.I.A.

In the earlier days the records accumulated by the testing associations consisted mainly of: (1) the amount and value of milk and butterfat produced by a cow, and (2) the amount and value of feed consumed.

Dairymen needed this information as a basis for culling their herds, for selecting cows from which to save heifers and bulls, and as a guide for intelligent feeding. The present day Dairy Herd Improvement Association testing system includes much more information and renders a greater service to the dairymen. The new life time herd books which are now used furnish a permanent, life-time production and reproduction history of the cows tested. An identification of each calf is recorded. The individual record sheet shows the date of birth of the cow, her sire and dam, the sire of each of her calves, and her freshening dates. With these records, the daughters of each herd sire used are identified. The records of production of his daughters are the means of proving a bull for his transmitting ability.

Organization:—There are several individuals and agencies concerned with dairy herd improvement association work. They are the dairymen, the Agricultural Extension Service, the U. S. Bureau of Dairying, and the supervisor. In many communities the records and information accumulated by the association are used by vocational agricultural teachers as instructional materials for both youth and adults. A group of dairymen, preferably from 20 to 25 who live in one county, form the membership of the association. Usually the county agent and the agricultural extension dairyman assume the leadership in forming the organization and in most instances serve in an advisory capacity in its operation. The Bureau of Dairying furnishes the books and most of the necessary forms for recording information. The supervisor is employed by the officers of the association and is usually recommended by the representatives of the Agricultural Extension Service.

Work of the Supervisor:—The supervisor has the responsibility of securing the milk weights for each

Courtesy U S Bureau of Dairying

Fig. 158. Mixing the Milk. Before taking a sample to be used for butterfat test, the milk is thoroughly mixed.

cow, determining by test the butterfat content of the milk, recording the amount of feed given each cow, and keeping complete records on each cow and on the herd as a whole. He keeps the records totaled and summarized for the dairymen. A report of the records is sent to the Agricultural Extension Dairyman, who in turn, upon approval, sends the information to the Bureau of Dairying for use as research data and for proving bulls. The supervisor is expected to advise with each dairyman on his feeding program, management practices, breeding program and other phases of dairying. Such advice is based on the records secured and on the supervisor's experience and observation of other herds.

The supervisor spends one day per month with each herd. With large herds it often takes two or more days to complete the required work. The supervisor arrives in the afternoon before milking time and usually completes his work the next afternoon in time to get to the next farm. It has been the general practice for him to have his room and meals at the home of the dairyman for whom he is testing that day. In recent years, with cars and highways making transportation easier,

Courtesy U. S. Bureau of Dairying

Fig. 159. Weighing the Milk. The milk from each cow is weighed and recorded in the barn book.

some testers spend the night at their own home and make the trip back and forth to the farms. This is the general practice in sections where all the dairymen in the association live within a small area. When it is possible for the supervisor to return to his own home each night, the duration of employment is usually lengthened, since he is likely to continue with his work after he is married. In general the work of a supervisor is regarded as a job for a single man.

Qualifications of a Supervisor:—Most of the testing supervisors are farm reared boys, who have had some experience with dairy animals. A supervisor should have not less than a high school education. Before being placed on the job he should be given special training in the specific duties he must perform. Such training is usually given in a dairy short course by the State Agricultural College. A supervisor must have or must acquire some knowledge in the feeding and care of dairy cattle, and in the production of milk. He must have or acquire considerable ability in mathematics. There are many calculations to be made and numerous records to be kept.

As in any other job which involves dealing with people, a supervisor must possess a personality that will enable him to easily approach people and to get along with them. He must have an interest in the work and be fully conscious of what his work means to the dairymen being served.

Daily Routine for a Supervisor:—The step-by-step jobs of a supervisor are listed below.

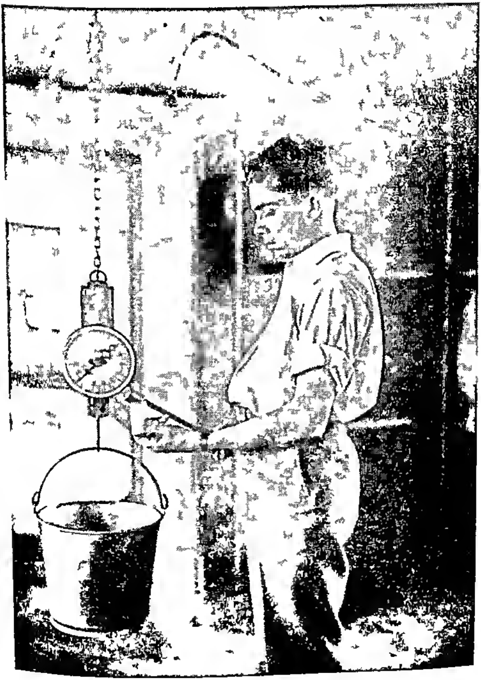
At afternoon milking—

1. Weigh and record milk from each cow.
2. Take a sample from each cow's milk.
3. Weigh the grain fed each cow.
4. Calculate accurately the amount of hay, silage and other roughage fed.

5. Identify each cow.
6. Secure calving dates on fresh cows and heifers.
7. Eartag new calves and make record of calf and eartag number.
8. Secure the price received for milk.
9. Determine costs to be charged for feeds.

At the milking the next morning and for the remainder of the day—

10. Weigh and record milk from each cow.
11. Take a sample of milk from each cow nnd complete her composite sample.
12. If same amounts and kind of feed are fed as at night feeding, calculate on basis of record secured; otherwise get morning's feed record.
13. Run Babcock test for fat on each sample.
14. Calculate milk and fat production for month.
15. Calculate value of milk and fat.
16. Determine amount of feed for month.
17. Calculate value of feed for month.
18. Show amount of profit or loss over feed cost.
19. Determine herd summary for production and feed.
20. Record data in herd books.
21. Enter any new cows in herd book, listing name, registration or eartag number, date of birth, name and number of sire and dam, and when cow was fresh.
22. Summarize records that have been completed.
23. Prepare folowing reports to be sent to County Agent and Extension Dairyman:
    a. Monthly summary of association
    b. Yearly herd summary when complete
    c. Lactation records when complete, not to exceed 305 days, and
    d. Other records as required
24. Discuss results of test with dairyman.
25. Participate in association affairs.



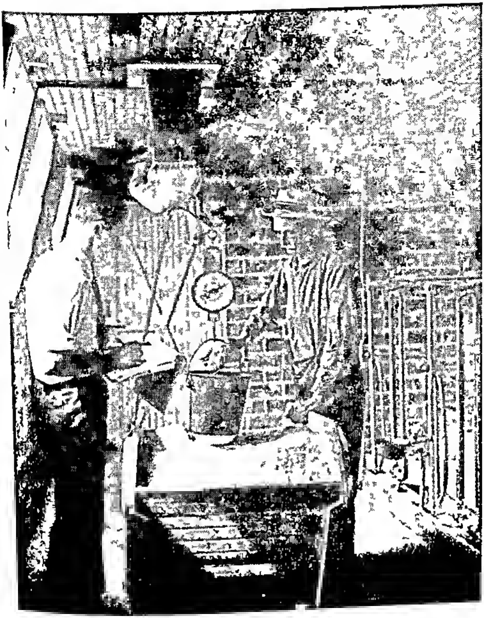
Courtesy U S Bureau of Dairying

Fig 160 Taking a Sample The milk is weighed and after it is thoroughly mixed a sample is placed in glass jar to be used for testing for butterfat

The best dairymen in the area are usually in the testing program. This work offers an opportunity for the supervisor to learn at first hand the practices carried out by the different dairymen and the results that they secure.

Testing Equipment: The standard testing equipment, which belongs to the association is taken from farm to farm by the supervisor. It is the responsibility of the supervisor to keep it clean and in good working condition. The required equipment consists of the following:

1. A 60-pound milk scale.
2. A 24-bottle Babcock centrifuge.
3. Standard glassware:
   a. 30 or more milk test bottles
   b. 2 milk pipettes, 17.6 cc
   c. 2 acid dippers, 17.5 cc
   d. 30 or more sample jars (2 ounce glass jars with screw caps)
4. Sample dipper.
5. Water bath.
6. Dairy thermometer.
7. Dividers for measuring fat column.
8. Bottle brushes.
9. Field box with bottle trays equipped with hasp for locking.
10. Lock and key.
11. Commercial sulphuric acid (1.82 specific gravity).
12. Computing book, slide rule or calculating machine.
13. D.H.I.A. eartagging outfit.
14. Tape for estimating weight of cow.
15. Supply of all forms used in recording the work, and for reporting records.
16. Brief case or suitable container for carrying records and forms.



Courtesy U. S Bureau of Dairying

Fig. 161. Weighing the Feed. The feed for each cow should be weighed and fed according to her milk production.

Official Testing

Official testing differs in some respects from work of the Dairy Herd Improvement Association. The dairy cattle breed associations sponsor official testing. It is called "Register of Merit" for the Jersey breed, "Advanced Registry" for Holstein, Guernsey and Ayrshire

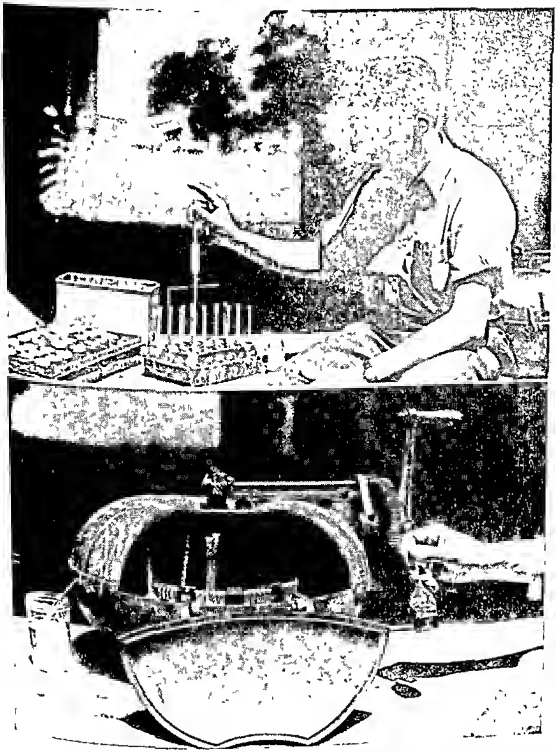
breeds, and "Register of Production" for the Brown Swiss breed.

The breed association usually designates a person in the dairy department of the State Agricultural College to act as superintendent of official testing for that state. He in turn selects supervisors who give direct supervision to the tests.

In this type of testing only registered cows are tested. The owner selects the individual registered cows to be tested. Those selected may be tested only during one lactation period or for more than one such period—at the discretion of the owner. Usually cows that are tested officially are given special care and feed and may be milked more than two times per day. The record usually represents what the cow can do under better than average conditions.

The name, official testing, indicates the type of testing. In order for the supervisor to carefully observe the rules of the breed association, only a limited number of cows can be supervised at one time. Cows are identified from the registration papers. Not more than two cows can be milked at a time. The supervisor must watch the cows milked. The first milking the supervisor observes is called the preliminary milking. He must see that the cow is milked completely dry and record the time. The test is then for the period ending 24 hours after the dry milking.

The owner keeps the milk weights of each milking for the entire period that the cow is on test. A copy of these weights is sent to the breed association at the end of each month. The association checks these weights against the report of the one day test made by the supervisor each month. The fat test for the one day is used for the test for the month. The pounds of fat for the month is calculated from this test and the daily weight of the milk as sent in by the owner.



Courtesy U. S. Bureau of Dairying

Fig. 162. Testing for Butterfat. These pictures show milk being tested for butterfat on the farm.

TABLE 41—GROWTH OF DAIRY-HERD IMPROVEMENT ASSOCIATION WORK IN THE UNITED STATES

Year	Associations	Herds on test	Cows on test	Average yearly production					
				Association cows			All cows milked in the United States		
				Milk	Butterfat		Milk	Butterfat	
	Number	Number	Number	Lbs.	%	Lbs.	Lbs.	%	Lbs.
1906	1	31	239	5,300	4.1	215	3,646	4.0	116
1907	4		1,606	5,366	4 1	220			
1908	6		3,921						
1909	25		11,656						
1910	40		[1]25,000						
1911	64		[1]40,000						
1912	82		[1]43,000						
1913	100		47,150						
1914	163		73,250						
1915	211		105,526						
1916	346		150,677						
1917	459	11,720	216,831						
1918	353	9,778	172,518						
1919	385	10,000	167,313						
1920	468	11,948	203,472	6,175	4.0	217	3,378	4.1	137
1921	452	11,209	193,928						
1922	513	12,508	215 321						
1923	627	16,356	277,010						
1924[2]									
1925[3]	732	18,677	307,073	7,159	3 9	284	4,219	3 9	165
1926	777	19,540	327,653	7,331	4 0	290	4,379	3 9	172
1927	837	21,128	362,011	7,411	4 0	293	4,491	3.9	176
1928	947	23,327	414,891	7,476	4.0	296	4,516	3.9	177
1929	1,090	25,192	465,604	7,495	4 0	298	4,539	3 9	180
1930	0,143	27,588	507,549	7,642	4 0	303	4,508	3 9	177
1931	1,112	26,308	510 714	7,812	3 9	306	4,459	3.9	175
1932	1,005	20,351	427,041	7,659	3.9	310	4,307	3.9	169
1933	881	15,447	358,501	7,849	4 0	313	4,180	3.9	164
1934	793	13,694	325,837	8,015	4 0	322	4,033	3 9	159
1935	809	15 573	364,218	7,977	4 0	322	4,184	3.9	165
1936	876	17,344	484,412	7,912	4 0	319	4,316	3 9	170
1937	992	20,772	496,582	7,923	4 0	320	4,366	4.0	173
1938	1,106	23,701	559,493	7,831	4 0	317	4,558	3.9	180
1939	1,228	25,949	625,254	7,977	4 1	323	4,589	4.0	182
1940	1,300	27,948	676,141	8,133	4 1	331	4,624	4 0	183
1941	1,383	31,381	763,502	8,225	4 1	335	4,742	4 0	188
1942	1,421	32,957	816,117	8,323	4 1	339	4,739	4.0	188
1943	1,057	24,155	616,972	8,325	4 1	338	4,604	4.0	183
1944	854	20,825	561,587	8 296	4 1	336	4,577		
1945	949	21,254	577,200	8,502	4 2	348	4,788		
1946	1,124	23,331	627 879	8,635	4.1	349	4,891		
1947	1,426	28 812	775,546						

[1]Estimated.
[2]Date for collecting data was changed in 1924 from July 1 to January 1
[3]Production records of association cows were not compiled each year on a Nation-wide basis prior to 1929
SOURCE Farmer's Bulletin No. 1974— U. S. D. A.

Herd Improvement Registry Test

The breed associations have another system of testing that falls between the official and Dairy Herd Improvement Association methods of testing. This is often called H.I.R. or simply "Herd Test." All reg-

istered cows in the herd are included. Milk weights are not required to be kept by the owner. This is the popular type of testing that is sponsored by the breed clubs.

SUGGESTIONS FOR STUDY

A. Questions and Problems

1. Tell how the first testing of dairy cattle was carried on. When was the Babcock test perfected?
2. How did the Dairy Herd Improvement Association get its start. What are the primary purposes of this Association? How are they organized? What are the duties and responsibilities of a supervisor? What are the minimum qualifications of a supervisor? What are his primary duties?
3. Explain what is meant by official testing. How does it differ from the work of a Dairy Herd Improvement Association?
4. What is meant by Herd Improvement Registry Test? How does it differ from the official testing and the testing carried on by the Dairy Herd Improvement Association.

B. Activities

1. Arrange for class to make Babcock butterfat test. Each boy to test for the butterfat of a cow from his own farm.
2. If there is a supervisor of a Dairy Herd Improvement Association near the school, arrangements should be made for him to appear before the class and explain his duties and the work of the association.

C. References

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3. Official Testing Rule Books of the Breed Associations, see pages 71-72 of this book for addresses.

CHAPTER XXI

NEW METHODS AND EQUIPMENT ARE MAKING DAIRYING EASIER

Dairy farming provides an income every month of the year. On the other hand the management of a herd —caring for and milking dairy cows—is a rather confining occupation. This feature is not looked on with favor by some, especially farmers who have been engaged in a one crop system with a great deal of leisure.

Dairy farming is just what the individual makes of it. He may make it a very interesting, exciting, and profitable business, or he may let it drift into unprofitable drudgery. A lot depends on the methods and equipment used. There are a number of practices and

Fig. 163. Good Cows Important. It takes less work and is much more profitable to produce 100,000 pounds of milk with 10 cows averaging 10,000 pounds per year than with 13 cows averaging 7800 pounds of milk per year.

various types of modern equipment that will lighten the load and indeed make it a much more pleasant and interesting means of livelihood.

Importance of Good Cows:—In the first place good cows are essential. It takes less work and is much more profitable to produce 100,000 pounds of milk with 10 cows averaging 10,000 pounds of milk per year than with 13 cows averaging 7800 pounds of milk. So the first step in making dairy farming easier and more profitable is to get and keep high producing cows. Why keep 13 to 15 cows to produce the same amount of milk that can be produced by 10 cows?

Convenient Buildings:—A dairy farmer spends much of his time feeding, cleaning, and milking the cows and cleaning the barn. In getting these things done, he should start looking for ways to save unnecessary labor and effort. A standard type dairy barn, or a loose housing barn with a small standard type milking barn should be the first consideration toward saving steps. The milk house should be located near the milking barn.

If there are more than 10 stalls in a milking barn, it is advisable to have them in rows. This facilitates the work involved in feeding, milking and cleaning. With two rows of cows, there are advantages in having the cows face out. This arrangement will help to keep the walls clean, especially in the summer when no bedding is used. It also makes it possible for all the milking to be done from one alley and the manure to be moved from only one alley instead of two. This is especially advantageous if the spreader is driven through the barn and the manure taken to the fields daily. If the manure is not hauled to the fields each day, a manure carrier saves much time. For large operations, there is a mechanical gutter cleaner that seems to be satisfactory.

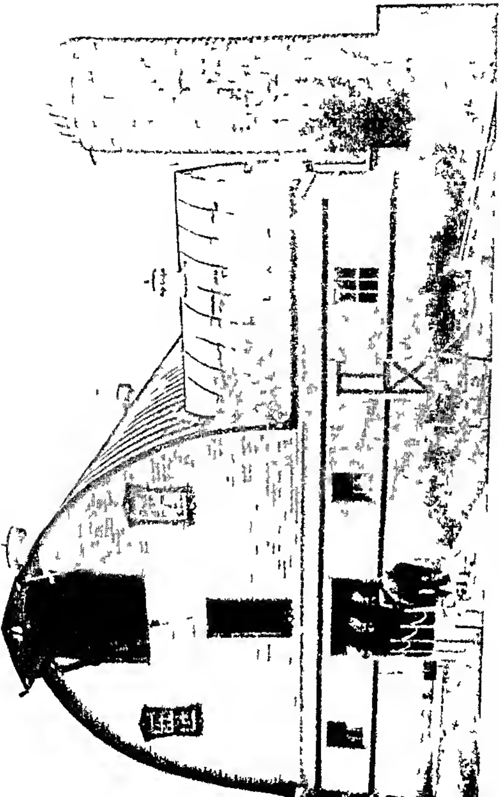


Fig 164 A Fifty Cow Dairy Barn. Carefully arranged barn and other facilities lightens the work in the operation of a dairy farm Note silo attached to the barn. This sho

Courtesy U S D A Extension Service

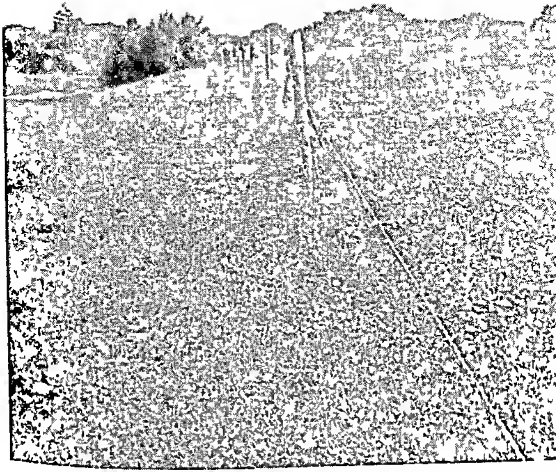
The stalls in the barn may be made in different lengths. Short stalls may be on one side and longer ones on the other side, or the stalls on each side may vary from one end to the other. This variation gives opportunity to line the cows up according to size and to have them fit the stalls. Cows placed in stalls that are too short are uncomfortable and may injure their udders when lying down. Stalls that are too long for cows placed in them make it more difficult to keep the cows clean. Adjustable stanchions will help to adjust the cows to the size of the stalls.

Labor Saving Equipment and Facilities:—The silo and feed room should be attached to the barn. This will tend to shorten the distance that must be traveled when feeding. A silage cart, either the manufactured type or one made at home, will save many steps. The cart should be so constructed that it can be set under the silo chute to be filled as the silage is thrown down. The mechanical silo unloader is a very desirable labor saving device for large operations.

The concentrate feed cart may be a standard commercially constructed type or one made at home of boxes or barrels mounted on wheels or rollers. In addition to saving a lot of labor resulting from much walking back and forth, the feed cart encourages more accurate feeding according to production. This may be accomplished by use of a feed scoop of a certain capacity or by having a feed scale mounted on the cart to weigh each cow's feed.

If cows are kept in stanchions, water cups should be provided. They allow the cows to drink water at will many times per day and in small quantities. This will increase production of milk to some extent.

To facilitate cleaning cows and producing clean milk, the hair on the belly, udder and flanks of the cow should be clipped close at regular intervals. If this



Courtesy U S D A Extension Service

Fig. 165. Electric Fence: The electric fence, which is inexpensive, easy to set up, and very effective, should be used wherever possible.

is done, less bedding and manure will cling to these parts of a cow. Short hairs on these parts make it easier to clean cows before milking. A vacuum type cleaner for grooming cows has been developed. As yet, it is not in general use and, therefore, its success cannot be definitely stated.

Facilities Outside the Barn:—To reach the barn, cows and men should not be forced to wade through mud and manure. To do so certainly does not make dairy farming easier or more interesting. Such conditions can and should be corrected. A lane can be made with concrete, rocks, timbers or other material that will give a clean surface on which to walk. Some markets require a concrete lane extending 50 feet in length from the barn. Such lanes, as well as fences and gates, should be

so located and constructed that they will be convenient and save steps. If these facilities are not carefully planned, located, and constructed, they will add to the work involved in caring for a herd. Gates should be located at proper places and so constructed that they will swing easily and at the same time be strong enough to turn cattle. The electric fence, which is inexpensive,

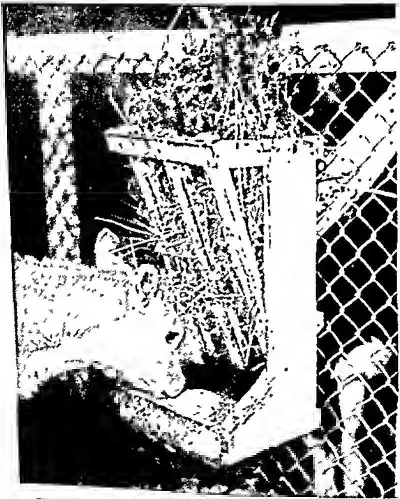


Fig. 166. Removable Feed Box and Hay Manger. A small removable feed box and hay manger is convenient for feeding the young calf.

easy to set up, and very effective, should be used wherever possible.

In the calf barn, small individual pens are preferable for calves for the first few weeks. This eliminates infection from one calf to another and prevents calves from sucking each other. If a slat or a wire frame is used as a sub floor in the calf pen, the urine will run through and leave the bedding almost dry. Less bedding material will then be required.

A small demountable feed box and hay manger is very desirable for each calf stall since it can be inverted to be cleaned. Being small, only a limited amount of starter feed and hay can be placed in it at a time. This helps to assure the calf being given fresh feed at all times.

Many dairymen prefer to use nipple pails for feeding calves milk. It is easier to teach calves to drink

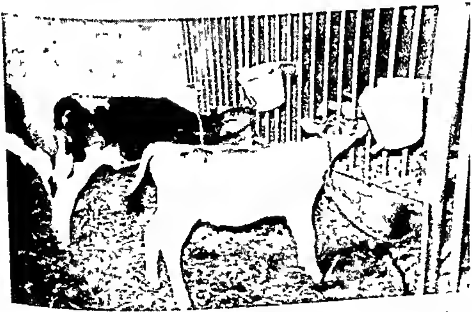


Fig. 167. **Drinking from Nipple Pails.** It is easy to teach young calves to drink from a nipple pail. A calf will drink more slowly from a nipple pail than from an open pail. This results in less digestive disturbances. If two or more calves are kept in the same stall, they can be fastened in stanchions or tied with short ropes at feeding time to prevent them from sucking each other.

from the nipple than from the regular pail. Calves get the milk more slowly from nipple pails and probably less of it goes into the rumen. There appears to be less indigestion among calves that are fed from nipple pails than those fed from ordinary pails.

Control of Algae:—In the summer months algae will grow in water tanks. It can be controlled by keeping a few crystals of copper sulphate (bluestone) in the bottom of the tank.

DDT Controls Flies:—Probably one of the most important new discoveries that has made dairying easier is the use of DDT in controlling flies and lice. In the past cows were sprayed once or twice daily and even then it was not possible to control flies. They were a constant nuisance to men and animals. At each milking the cows would come in from the pasture covered with flies. The residue of the spray used in the past would often gum up the hide and hair of the cows. The ceiling and walls of the barn would require painting every year to cover fly specks.

With the proper use of DDT—consisting of two sprayings of the barn and three of the cows per year—flies can almost be completely eliminated. Those that do find their way into the barn soon die after coming in contact with DDT on the walls and ceiling of the barn. Details of how to use DDT in controlling flies are contained in Chapter XVII of this book.

Control of Weeds:—Another important new chemical development, known as 2-4D, is proving successful in the control of many kinds of obnoxious weeds. This chemical spray saves much labor and helps to make dairying easier.

Quaternary Ammonium Compounds:—The use of quaternary ammonium compounds for washing cow udders has some advantages over chlorine. There are

many of these compounds under various trade names, including roccal, emulsept, BTC, hyamine T, and aldibac. They have proved equally effective as chlorine in reducing the number of bacteria on the cow's udder. In cold weather when used in hot water they do not cause the hands and teats to chap as do chlorine agents.

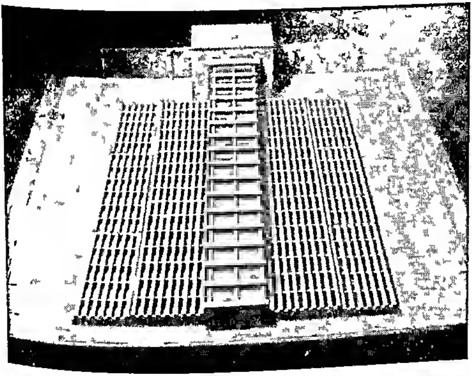


FIG. 168. Barn Hay Drier. This picture shows a model of a barn hay drier. Its use makes a dairyman less dependent on the weather for curing hay.

Labor Saving Practices and Equipment:—The work of curing, storing and feeding roughages constitutes a large per cent of their cost. When pastures furnish a larger percentage of the feed the cost is reduced. In a pasture the cows harvest their own roughage and there is no cost for curing, storing and feeding. Permanent pastures should be supplemented with temporary pastures which provide early spring, mid-summer, late fall, and some winter grazing. There is opportunity in the South for greater use of temporary pastures,

which will materially reduce feed and labor costs. The pickup hay baler and the field chopper eliminate a very high per cent of the hand labor necessary in other methods of handling hay.

The use of the barn hay drier is increasing very rapidly. Its use makes the dairymen less dependent on the weather. The drier makes it possible to store the hay without a great loss of leaves, which contain the richest content and highest quality of protein, vitamins, and minerals.

Hay should be stored where it is readily accessible for feeding. This saves extra handling. It is costly to move loose hay great distances by hand. In moving such hay much of the leafy part is usually shattered and lost.

A metal container in the shape of a silo has been developed for storing hay. The walls are perforated and it has an open shaft through the center. This makes it possible for a fan to pull air through the hay to complete the curing. The hay is chopped and blown into the storage container. In a few such facilities the base is made in the form of a cone with a manger around the bottom of the structure, which makes a self-feeder. This new facility for making dairy farming easier is still in the experimental state, but has been reported to work satisfactorily.

Milk House Practices and Facilities:—There are certain practices and equipment that can be used in a milk house which will lighten the load in handling milk. A standard sized milk house with adequate space and facilities makes the job of handling milk much easier. A two-tank wash vat facilitates the cleansing and rinsing of utensils much better than tubs. Automatic water heaters and sterilizers save much labor and effort which is required if wood or coal burning water heaters

are used. The use of chemical sterilization saves some labor and expense. Such chemicals can only be used in places where they are acceptable to the health authorities. The job of washing milk utensils is speeded up by the use of the best cleaning powders and a wetting agent.

Studies have revealed that when wet storage is used, milk that was not pre-cooled before immersing the cans in cold water did not increase in bacteria count much more than milk that was cooled previously by the use of a tubular cooler. It is necessary to agitate the water around the cans and to keep the water level up to the level of the milk in the cans. This is probably the cheapest method for small operators to use in cooling and storing milk. For large operations, there appears to be a trend to use a direct expansion cooler and then hold the milk in dry storage.

Some dairymen have already eliminated milk cans and storage boxes for holding milk. This is especially true of operators in certain areas of Florida and California. They are using insulated storage tanks for holding the milk until it is picked up by a tank truck. Some large producers are using holding tanks that are mounted on trucks which are used to deliver milk directly to the distributing plant.

Managed Milking:—On a dairy farm, all of the work and expense is directed toward the production of milk. The growing, harvesting, storing, and feeding of crops; the growing of the young stock; and the caring for the cows are all made possible by the amount of milk that is obtained at each milking. This job should, therefore, be given great care. A dairyman should be interested in developing managed milking rather than in getting through with the job in a hurry. In recent years important new information dealing with the physiology of

Courtesy U.S.D.A. Extension Service

Fig. 169. Washing Udder. The udder of the cow should be thoroughly washed with warm water (about 100° F.) just before the cow is milked. This is to stimulate "let down" of the milk as well as for sanitary purposes. The stimulation lasts only about seven minutes—thus the milking of a cow should begin in about two minutes after udder is washed.

milk secretion and milk discharge has been discovered by Peterson and associates of Minnesota and physiologists at several other experiment stations. The application of this new information in the last few years has resulted in more changes in the method and procedure of milking cows than had previously occurred in possibly fifty years.

The important steps in managed milking may be summarized by the following brief statements:

1. All the milking equipment should be ready before milking is actually started.

2. The udder of the cow should be thoroughly washed with warm water (about 100° F.) just before the cow is milked. This is to stimulate "let down" of the milk as well as for sanitary purposes.

3. Each teat should be fore milked into a strip cup to further stimulate the "let down" of milk, to open the teat canal, to get rid of the first few streams of milk, and to check the cow for any abnormal milk.

4. Milking should begin in about two minutes after the cow's udder is washed. The stimulation only lasts about seven minutes.

5. If hand milking is used, the milking should be completed as soon as possible.

6. If machine milking is used, the cow should be stripped as soon as the milking appears complete. The cow should be stripped with the machine, by first pulling down on the teat cups with one hand and then massaging the udder with the other hand. The quarters that have not been completely milked out should be given most massaging. The teat cups should be removed as soon as all the milk has been obtained. However, no milk should be left in any of the quarters.

Fig. 170 The Pay-off Job. Milking is the pay-off job on the dairy farm. The milking machine is the greatest labor-saving piece of equipment on the dairy farm. It certainly pays to do a good job of managed milking.

It has been found that the procedure described above results in a better job than the old method of milking, which included the washing of the udders of all the cows before beginning to milk and the hand stripping of cows milked by machines. Any system must be used with judgment. Cows are individuals and respond differently. No attempt should be made to make all cows three minute cows.

The milking machine is a labor saving device that is used twice each day. Some of the labor saving machines for dairy farms are used for only a limited number of days each year—yet, some of them cost more than a milking machine. In addition to saving time the mechanical milker changes a rather difficult job into one that is not generally disliked by those who do the milking. A good hand milker can milk from 6 to 10 cows per hour. By using milking machines this number can be more than doubled. The number that can be milked in an hour depends on the number of units used and the alertness and speed of the operator.

Milking the cows accounts for about one-half of the entire time required for the care of the cows, the milk, and utensils.

In organizing work to make dairying easier and to reduce the amount of work per cow, it is important to study the results in order not to go so far that production is decreased. The cow as an individual is the limiting factor. It has been found that some farms with the least labor per cow also have the lowest production. In general less than 125 hours per cow per year (30 cows or more per man) does not adequately take care of the herd. Studies show that above 180 hours of labor per cow (20 cows per man) does not appear to result in any better care for the cows—so far as production is concerned—than an average of 150 hours (25 cows per man).

The items and topics discussed in this chapter are some of the things that have been developed in recent years to help make dairying easier and to eliminate much of the drudgery formerly associated with this important farming occupation. In the years ahead there will, doubtless, be many more developments that will help to make dairy farming more and more pleasant, interesting, and profitable.

SUGGESTIONS FOR STUDY

A. Questions and Problems

1. What are some of the things that should be kept in mind when planning convenient dairy buildings? What are the advantages of constructing the milking barn so that cows will face out?
2. Name some of the more important labor saving equipment and facilities that should be on a dairy farm to make the occupation easier.
3. How may algae be controlled in water tanks?
4. What are some of the important chemical compounds that are helping to make life more pleasant on dairy farms? For what purposes are they used?
5. What are some of the latest developments in the selling and storing of milk?
6. What are the important steps in managed milking? How do they differ from the old method and procedure of milking?

B. Activities

1. (a) After reading this chapter visit a modern dairy farm and find out to what extent new methods and equipment are being used to make dairying easier. Make a list of the additional

things that should be done on this farm to make the occupation more pleasant, interesting and profitable.

(b) Find out what per cent of the year the cattle secure ample roughage from permanent and temporary pastures. Also, what grasses and legumes are used for temporary pastures.

C. References

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Chapter XXII

THE MAN AND THE COW IN THE PRODUCTION OF MILK

The man in charge of a dairy herd is one of the most important factors in the development of cattle and in the production of milk. It is equally true for the quality of milk produced as it is for the quantity. There is a great deal of difference in the production of milk from similar herds kept in similar barns and fed the same kind of feeds in about the same amounts. The difference is caused largely by the effectiveness with which the cows are handled. Wherever you find an outstanding herd you also find a competent person in charge.

Progress in the development of dairy cattle, especially during the past forty to fifty years, has been brought about by changes in the inheritance of the cattle and improvements in their environment. Good dairy cattle are used as tools to improve the standards of living of people. The conditions under which a present day high producing cow lives is much different from the natural conditions of the cow in her native habitat. As cows become more highly specialized milk producing animals, they require more careful handling, greater production, and better feeding than cows in their native habitat. This is especially true if they are to produce to their full capacity.

Good Cows Essential

There is a wide variation in the production of cows due largely to the difference in the ability of cows and the methods of man in handling them. When good cows are in the hands of good dairymen high production records may be expected. A study of the produc-

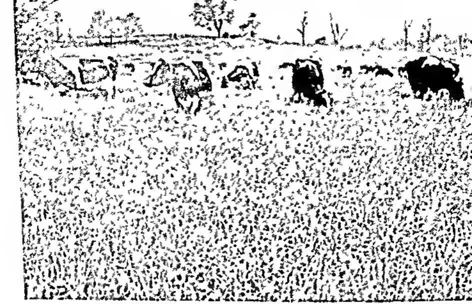


Fig. 171. Harvesting Their Own Feed. These cows are grazing ladino clover and orchard grass. They are harvesting their own feed and thus there is no labor cost for harvesting, curing, storing, or feeding.

tion records of three classes of dairy cattle shows the relationship of the producing ability of cattle and proper handling by men. The highly developed purebred cow under man-made official test conditions may produce thirty to forty thousand pounds of milk, and 1,000 or more pounds of fat per year. The 627,878 cows on Dairy Herd Improvement Association tests in the country averaged 8,635 pounds of milk and 349 pounds of fat in 1946. They were handled under good dairy farm conditions. The average production for all the cows in the United States in 1946 was only 4,891 pounds of milk per cow and about 195 pounds of fat.

Factors to be Considered in Selecting Cows:—In selecting cows for replacement one should study the production records of the animals, if such are available. For the vast majority of cows no production records are available, since only about 3 per cent of the cows in the nation have been tested. In studying the records of a cow one should find the answer to such questions as the following: What is the cow's produc-

tion record in terms of pounds of butter fat? Was the record made in ten months or 12 months? Did she drop a calf within 12 or 13 months or was she held open or failed to breed and had a long calving interval? Was the cow milked two or three or four times per day? Did she run with the herd as a whole or was she cared for individually? At what age did she make the record?

There is no one answer as to what should be expected in the way of a record. A lot depends on the production record of the entire herd. To improve the herd, one would certainly expect replacements to produce at or above the average for the herd. The range of production within the herd offers the opportunity to build onto or above the average. Some culling may be done at the bottom to improve the average production per cow of the whole herd. The amount of culling that can be done economically depends to some extent on the number of cows that must leave the herd for other reasons and how many animals have been raised for replacements.

In the Dairy Herd Improvement Association herds of Virginia 20 per cent of the cows are replaced yearly. *The average age of leaving the herds is about 7½ years* which means they are in the milking herds about 5 years. In herds on the Eastern Coast where most of the replacements are purchased, cows remain in herds, on an average, of less than five years.

Cows are also selected as to type. This is true in the show ring and in breed classification programs. It is also true in the individual herds. In the purebred herds cows are selected for certain characteristics that are typical of the breed, such as refinement, specific color, straight backs, level rumps, and other qualities that are typical of the breed concerned.

Courtesy U.S.D.A. Extension Service

Fig. 172. Temporary Pasture. In the South there is great opportunity for dairymen to use temporary pastures of small grains and clovers for late fall, winter and early spring grazing. This picture shows temporary pasture planted to oats.

Animals that possess too many characteristics that are not typical of the breed are usually eliminated. In all herds, both grades and purebreds, the acceptable type must include those qualities that will make it possible for the cow to continue to produce on a profitable basis over a long life period. A cow must have strength of constitution to last, a large capacity to consume and be able to digest and assimilate large quantities of coarse feeds. She should have strong feet and legs to keep her going, and an udder containing sufficient milk secreting tissues to make large quantities of milk. However, the udder must be attached snugly to the body in order for it to be protected. An udder that is considered acceptable today is far different from one that was judged satisfactory twenty-five years ago.

Yet the things discussed above are not all that are considered in selecting dairy animals. Cows vary as individuals just as people do. A dairyman once asked one of the authors of this book to select a bull for him. He wanted more than production and type. He wanted the dam of his bull to be from a cow family that handled easily, that is, not especially nervous. He also wanted the cow family to have a record of being easy to milk. This dairyman and his family handled the herd themselves and these qualities meant a lot to them. He knew that these qualities were inherited as well as milk production and type.

There are many variations in animals. Some have the ability to reproduce rapidly or to build a large family while others reproduce slowly or run out entirely. In a study of one herd over a period of twenty years it was found that of 14 foundation animals, 7 of them had run out entirely at the end of 20 years, while one of the foundation cows had 44 female descendants living in the herd at that time. The others were represented by from 4 to 27 females.

Courtesy U.S.D.A. Extension Service

Fig. 173. Milking Machine Saves Labor. This picture shows milking machine being put on cow. The use of milking machines greatly reduces the amount of labor necessary for milking cows —which amounts to about one-half of the entire time required for the care of the cows, the milk and utensils.

Many pages have been written and much has been said about the selection of heifers for replacements. It becomes necessary, however, to select heifer calves from cows that produce heifer calves. Some cow families are prolific. They produce a large number of calves with probably a high percentage of heifers. The calves are strong and most of them find their way into the milking herd. Other cow families do not do so well in producing calves. Only a few calves may be produced and a small per cent of them heifers. Then, there are weak strains with a high calf mortality or that drop calves that develop slowly. Such poor breeding strains might be called hard-luck families.

Some cows, after they get into the milking barn, go year in and year out without requiring any special attention. Others continually require special care and attention. They may go off feed for little or no

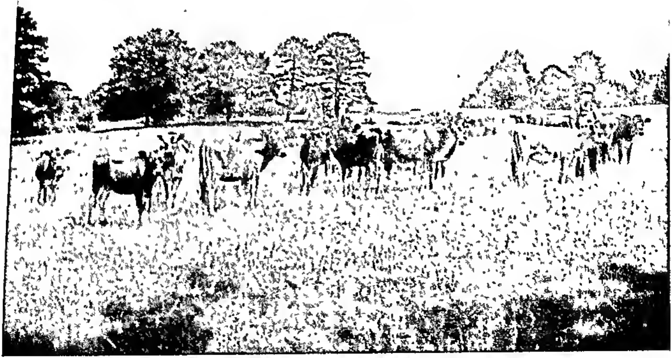
reason, develop fowl foot or udder trouble, or be easily susceptible to any number of common ailments. All these things are a part of the cost of maintaining a herd and producing milk. Many such characteristics are, at least, partially inherited. They should receive consideration in selecting animals on which to build the herd. Though longevity is an inherited factor, it is influenced greatly by proper management or the lack of it.

The Important Part Man Plays

Next, let us consider the important part that man plays in developing cattle and producing milk. Results in terms of milk produced depend on good cows, properly fed and managed by some one who likes good cattle. The person in charge of a herd must see to it that the cows are fed and milked regularly, and that proper comforts are provided.

Production Factors Involving Man:—The cow is a creature of habit and responds to a careful routine of feeding, handling and milking. It is not a difficult matter to tell whether cows are handled carefully and gently or treated roughly. They will give you the answer when you go among them in the field or in the barn. When you walk among them do they remain quiet and continue to lie down and chew their cuds or do they jump up and run away? When you approach the cows while they are fastened in stanchions, do they become nervous and turn around to watch you? When they are turned loose do they go out easily or do they pull back on the stanchion before you even get to them, and when turned loose make a dive out of the stall and through the door? A cow will do her best only when she is handled with care and ease.

A keen eye will detect a cow that is "off" before she has gone far, and the cause may be corrected before much damage is done. This is especially true in early



Courtesy U.S.D.A. Extension Service

Fig. 174. Cows Should Be Handled Gently. This picture indicates that this Mississippi dairyman's cows are not afraid of him. He doubtless handles them carefully and gently. A cow will do her best only when she is handled with care and ease.

symptoms of impaction, off feed, injury, lameness, udder trouble, looseness, lousiness, ring worm, milk fever, and many other ailments. The old adage, "the eye of the master fatteneth his cattle," certainly expresses a basic truth.

The personal attention of a dairyman enters very strongly into the well being of the herd. Many a calf that is reported still born would be counted among the living if an attendant had been present at time of birth to assist the cow and prevent undue delay of delivery, or probably to remove the membrane from over the calf's nostrils immediately after birth.

The calf has an inherent right to be dropped in a clean lot or stall that is protected. Just as soon as the mother has cleaned it up, painting the navel with iodine or some other disinfectant will lessen the chance of infection. A feed of colostrum from clean teats and udder gives the calf a rightful chance to be raised instead of buried.

The isolation of a cow, that is sick or lame will prevent possible infection of other cattle and annoyance of the one that is ailing. Cows that are in heat should be kept separate from the rest of the herd. This little extra trouble protects the herd from much annoyance and helps to maintain satisfactory production.

In the milking herd a careful eye will see that the cows always have access to water at reasonable times, and that salt and minerals when necessary are available. If the milk sheet is checked, or at least the milk pail observed, the milk flow will tell the herdsman if the cow is not normal.

There are times when it will pay to feed certain scarce feeds judiciously in order to maintain a satisfactory flow of milk. For instance, if the silage supply is short, more milk will be produced by feeding a

rationed amount each day throughout the barn feeding period than by feeding heavily a part of the time and having none to feed the rest of the time. In the same way if there is a limited quantity of good hay and some low quality hay will have to be used to finish out the feeding period, more milk will be produced by feeding some of each kind throughout the period than by feeding only the poor hay a part of the time. The poor quality hay should be fed at time of day when the cows have a long time to eat it.

Other Factors:—There are other factors in addition to good cows, satisfactory feeding practices, and a man who is willing to do his part—that help to determine high or low production levels for the herd. One of these is the growing out of replacements to sufficient size.

Young heifers should be bred to calve at the right age, which ranges from 24 to 29 months according to breed and development. An under fed heifer or one that is bred too young comes into the milking herd without enough size to do the job. If heifers are held too long before breeding, time and money is lost and no advantage is gained in production. It is estimated that it takes two years in production for a cow to net sufficient money to pay for her raising. Then the profit from a cow must come from the productive life above these two years—which means that a cow is usually over 4 years old before she begins to return a profit. A cow that stays in production 6 years should actually return twice as much profit as one that stays in the milking herd only 4 years.

A study of a herd of 108 cows showed at the end of the year an average age of 5.8 years and the following range in age:

Years of age	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
No. of cows	10	19	21	18	13	9	4	8	2	1	1	0	1	0	1

The breeding efficiency will influence the total milk produced as well as effect the seasonal production. It is a sound practice to breed cows within the third month after calving. This is usually at the third heat period. With conception at this breeding it will give a calf every twelve months. While this is seldom achieved, a 13 months calving interval is satisfactory. A management program that will give this should also allow six to eight weeks dry period. A breeding program based on producing a calf a year per cow will carry several modifications. The majority of the cows should be bred in the third month. Some that have previously been slow or difficult breeders should be bred earlier. Every time a cow or heifer comes in heat there are some physiological changes that take place in the ovaries and uterus. The more heat periods passed over before breeding offers that many more opportunities for these changes to develop abnormal conditions in the organs and decrease the conception rate.

In milk sheds where a fall milk production base is required, it is essential that a majority of the cows calve in the fall. This causes added problems in developing a satisfactory breeding program. More bulls must be kept since most of the breeding must be done in a short time. The breeding age of heifers may have to be changed. Some cows may have to be bred earlier than three months after calving and some may have to be held longer. However, this practice is questionable.

A survey of a herd in good breeding condition showed a calving interval of 12.8 months for 81 cows that had calved two or more times. The practice in this herd was to breed the majority of the cows in the third month. Some that calved in the winter were bred earlier in an attempt to level out the production by more fall freshening. Also some that calved in the

early summer were held longer. Those with previous histories of difficult breeding were bred earlier. The intervals that averaged 12.8 months from one calving to the next were as follows:

	In Months								
Calving Interval	10	11	12	13	14	15	16	17	18
No. of cows	11	18	19	9	8	9	3	2	2

The average dry period during this year was 60 days. It was lengthened slightly by longer dry periods for those cows, especially some old cows, that had longer intervals.

The study of production levels in herds, reveals that too many of the herds are below the profit dead line. The average production of the better herds has increased steadily. To-day higher production and greater efficiency is essential, if the dairy farmer is to maintain his standard of living and to educate his children. In 1926 the U. S. Bureau of Dairying reported that about 45 per cent of the Dairy Herd Improvement Association cows were below the 275 pound fat production level, and about 15 per cent above 375 pounds. In 1948 about 23 per cent produced below 275 pounds of fat per cow and 34 per cent above 375 pounds. In this same year about 15 per cent produced about 425 pounds of butterfat per cow.

Dairymen are continually striving to step up the level of production by breeding superior cows and improving feeding and management methods. Much study is constantly in progress to find ways and means of stepping up production. A study of a herd averaging 102 cows for the year showed that 125 different animals were used to make up the herd during the year. The average yearly production per cow was 10,157 pounds of milk and 434 pounds of fat. Further

study showed a wide range in the production of individual cows. These records included two year old heifers as well as old cows which, of course, influenced the range in production. The distribution was as follows for all cows that had completed a lactation record:

Level of production	Heifers with incomplete records	200-300 lbs fat	300-400 lbs fat	400-500 lbs fat	500-600 lbs fat	600 lbs fat
No. of cows	21	3	27	45	18	4

In considering factors that contribute to more milk production one must keep in mind the part cows play and the things that man must do. Many of these things are actual jobs that man must do over and over from day to day. Others are based on the necessary planning that must be done, which plays an extremely important part in the final accomplishments. All of these things apply equally to the dairyman with grade cows and to the pure bred breeder. The economical production of dairy products—the most important human food—and the improvement of dairy cows is vital to the well-being of the people of a nation. To make satisfactory accomplishments the people who engage in dairying must have a love for the work and be sincerely interested in upgrading cows and improving production methods. A great deal of the future progress of the dairy enterprise of this country depends on the men who enter the occupation and their attitude toward the whole industry.

SUGGESTIONS FOR STUDY

A. Questions and Problems

1. What are some of the things that have caused the great progress in the development of dairy cattle and the production of milk in recent years?
2. Why are high producing cows so essential to profitable dairy farming?
3. What are some of the factors to be considered in selecting dairy cows?
4. Why is the part man plays in developing cattle and producing milk so important? Whnt are some of the production factors involving man? Discuss some of the things man can do to encourage more efficient production.

B. Activities

1. Arrange for a successful dairy farmer to show the class his barn and other facilities and point out the things man must do to make dairying profitable. Allow pupils to ask questions.
2. Arrange for pupils to study production records of a dairy herd.

C. References

1. Feeding, Care and Management Of Young Dairy Stock. Farmers Bulletin, No. 1723, U.S.D.A.
2. Selecting Dairy Cattle, by W. B. Nevens and A. F. Kuhlman, Illinois Agricultural Experiment Station, Circular 486.

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